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SEPTEMBER 2019 ISSUE

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More Efficiency with Less Labor: The Coming Age of Autonomous Equipment

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More Efficiency with Less Labor: The Coming Age of Autonomous Equipment

The agriculture industry has been steadily adopting more and more digital advancements that have been made available since the coming of the new millennium. The implementation of technological breakthroughs appears to be coming at a more rapid pace as connectivity improvements and software innovations increasingly develop. One particular area of technological advancement that is projected to grow significantly in the coming years is the development and demand for autonomous farming equipment.

See full article on page 62



HOW MUCH PRUNING IS NECESSARY IN MATURE ALMONDS?

By ROGER DUNCAN | Pomology Advisor and Director, University of California Cooperative Extension, Stanislaus County

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Unpruned trees can be ugly, but productive. All photos courtesy of Roger Duncan.

AFTER THE FINAL WINDROWS OF THE SEASON are swept and picked up, many almond growers consider whether they should prune their bearing almond trees. The answer depends on what the goals might be. Limbs that are broken, diseased, are in the way of

cultural practices or present safety concerns should be periodically removed. If the goal is to increase or prolong yield of the orchard, the answer is probably no. Past and current University of California (UC) trials suggest that growers are not getting a return on their pruning investment if their goal is to improve yield. In fact, the numbers suggest the opposite: the more growers prune, the more they may reduce their yields and profits, even in the long term.

One of the first long-term trials to look at minimal pruning of almond was as at the Nickels Estate Soil Lab in Arbuckle, conducted by now retired University of California Cooperative Extension (UCCE) farm advisor, John Edstrom. Planted in 1979, this trial examined the best way to maintain yields in closely spaced trees. After 21 years, “unpruned” Nonpareil trees were still yielding as well or better than trees that had been pruned every year for the life of the orchard (Table 1, see page 5). In the 21st and final year of the study, unpruned trees produced 2307 pounds per acre compared to 2136 pounds per acre in the annually pruned trees. Over the 21-year span, cumulative yields were 35,082 pounds per acre in the “unpruned” trees compared to 34,176 pounds per acre for trees that were pruned every year. In this case, the grower would have paid to prune for 21 years and would have had 906 fewer pounds of almonds in the end.

Since then, at least three other long-term trials have been conducted in the northern, southern and central parts of the state. John Edstrom established a second trial at Nickels in 1997 with a tree spacing of 16 feet x 22 feet. Now monitored by UCCE advisor Franz Niederholzer, the yield results from this second field trial continue to question the need for regular pruning to maintain almond production. Both Nonpareil and Monterey showed no significant yield

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differences between annually pruned and unpruned trees in cumulative yield for over 20 years.

Kern County Trial

Prior to his retirement, Kern County UCCE Farm Advisor, Mario Viveros, compared trees that were pruned annually or semi-annually by hand or mechanically. These trees were spaced widely by today's standards (24 feet x 21 feet) and were planted in a deep Wasco Sandy Loam soil. In the eleven-year-old trial, cumulative Nonpareil yields were 2291 pounds per acre higher in unpruned trees than trees that were pruned conventionally every year for eleven years (Table 2). Carmel yields were 1879 pounds per acre higher in unpruned trees. Mechanical topping and hedging, whether done every year or every other year also did not increase yields. Yields were lowest in trees that were pruned by hand and mechanically hedged each year.

Stanislaus County Trial; 2000-2018

In Stanislaus County, I started a long-term pruning trial to verify to myself that pruning did not improve yield. The trial includes Nonpareil and Carmel on Nemaguard and Hansen rootstocks with in-row tree spacing of 22, 18, 14 and 10 feet. I included the following four pruning treatments:

- "Standard" training to three scaffolds, followed by annual pruning.
- "Standard" training for two years, then unpruned thereafter.
- "Minimal" training to multiple scaffolds, followed by annual pruning.
- No scaffold selection and only occasional removal of limbs in the way of cultural practices.

Table 3 (see page 6) shows that Nonpareil yields were almost identical in 2018 whether trees had been annually pruned for 19 years or not.

Continued on Page 6

Table 1. Nickels Estate Pruning Trial
Cumulative Yields Through 21st Leaf (1984–1999)
7ft x 22ft spacing in Class III Soil

	Kernel pounds per acre				
	18th Leaf	19th Leaf	20th Leaf	21st leaf	Cumulative
Annually pruned	2624	2498	2494	2136	34,176
Unpruned	2833	2680	1958	2307	35,082

Table 2. Kern County Pruning Trial
Cumulative Yields Through 11th Leaf
24ft x 21ft Spacing in Wasco Sandy Loam Soil

	Cumulative Kernel Pounds/Acre		
	Nonpareil	Carmel	Monterey
Unpruned trees	21,536	23,577	21,843
Annually Pruned	19,245	21,698	20,841
Pruned in alternate years	20,585	20,363	21,313
Topped & hedged annually	20,667	22,771	22,153
Topped & hedged in alternate years	20,088	22,561	20,831
Mechanical + hand pruned annually	18,643	20,248	20,090

“Carmel yields were 1879 pounds per acre higher in unpruned trees.”



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Cumulative yield in annually pruned Nonpareil trees is about 900 pounds less than trees that were trained for two years and then left essentially unpruned for the last 17 years. Pruned Carmel trees yielded a little less than unpruned trees in 2018 and have accumulated about 4400 pounds less than trees that were not trained and have been essentially unpruned for 19 years. Including yield loss and \$150 per year in pruning costs, annual pruning would have reduced gross income by more than \$9,000 per acre over the 19 years of this trial.

Mechanical Topping of Nonbearing Trees

Some almond growers in windy areas consider mechanically topping their almond trees in the fall after the first growing season to quickly reduce tree height in an attempt to reduce tree leaning and/or blowover during the winter. It has been suggested that topping might lead to shorter, bushier, more productive trees. The short and long-term effects of this practice need to be evaluated.

A field trial was established in November 2014 in a first-leaf Nonpareil and Monterey orchard on the vigorous Titan peach/almond hybrid rootstock to test the effects of mechanical topping. Prior to topping, Nonpareil trees were over nine feet tall and the Monterey were about eight feet tall. Trees in this trial were either mechanically topped to a height of 5.5 feet by a custom operator or left untopped. Topped and untopped trees were subjected to various levels of scaffold selection by a hand pruning crew for initial tree training. All trees have been minimally pruned after the first year. We have compared tree size, anchorage and yield through the 5th leaf.

Effect of Topping:

- Although mechanical topping initially reduced tree height substantially, topped trees were just as tall as untopped trees by the end of the next season. Topping resulted in very vigorous shoot regrowth, and a “crows’ nest” effect where the cuts occurred. It is unknown if this crows’ nest will

Table 3. The Effect of 19 Years of Pruning on Yield of Nonpareil and Carmel Almonds in Stanislaus County Minimal Pruning Trial

	Nonpareil		Carmel	
	2018 Yield (lb/a)	Cumulative thru 19th leaf	2018 Yield (lb/a)	Cumulative thru 19th leaf
Trained to 3 scaffolds; Annual, moderate pruning	2998 a	41,326	2461 b	38,851
Trained to 3 scaffolds; Unpruned after 2nd year	3080 a	42,237	2784 ab	41,732
Trained to multiple scaffolds; Three annual pruning cuts	2901 a	39,739	2591 ab	40,780
No scaffold selection; No annual prunings	3004 a	42,278	2801 a	43,274

Table 4a. Early Yield of Nonpareil Almonds as Affected by Mechanical Topping

	3rd leaf	4th leaf	5th leaf	Cumulative Yield
Untrained	649 a	2687 a	2924 a	6260 a
Scaffold selection by hand; “medium” pruned	538 abc	2397 ab	2626 ab	5561 ab
Scaffold selection by hand; “short” pruned	402 c	1981 c	2779 ab	5162 b
Mechanically topped; no scaffold selection	561 ab	2223 bc	2915 a	5699 ab
Mechanically topped with hand scaffold selection	608 ab	2231 bc	2403 b	5359 b

Table 4 b. Early Yield of Monterey Almonds as Affected by Mechanical Topping

	3rd leaf	4th leaf	5th leaf	Cumulative Yield
Untrained	785 a	3277 ab	3134 ab	7196 a
Scaffold selection by hand; “medium” pruned	651 ab	3309 a	3260 a	7220 a
Scaffold selection by hand; “short” pruned	506 b	2857 ab	3020 ab	6383 bc
Mechanically topped; no scaffold selection	608 ab	3077 ab	3112 ab	6797 b
Mechanically topped with hand scaffold selection	642 ab	2620 b	2653 b	5915 c



Untrained vs. mechanically topped.



Excessive bud break and crows nest from topping cuts.

lead to more rapid shade out of the lower canopy.

- As did all pruning treatments, topping reduced trunk circumference compared to unpruned trees for two years but trunks were of similar size by the 5th leaf. Although pruning (topping) can cause vigorous regrowth of shoots, it is a stunting process overall, including trunks and roots.

- Topping did not improve tree anchorage. Some leaning started during the first growing season, prior to topping in the fall. Because of the vigorous regrowth, topped trees may have had thicker canopies by the end of the second growing season.

- After five years, cumulative yields of topped Nonpareil trees, with or without follow up scaffold selection by

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hand, was similar to trees that were conventionally trained by hand.

- Mechanical topping reduced yield of Monterey, especially in trees that had follow up scaffold selection by hand.
- The most expensive pruning treatment was mechanical topping with follow up scaffold selection by hand.

Summary

Untrained trees and trees trained to

multiple scaffolds are more susceptible to scaffold failure, especially during the development years. Untrained trees are also somewhat more prone to blow over the first couple of years due to a larger canopy. The more closely trees are planted down the row, the smaller they will stay and the less training and follow up pruning they will require.

Training non-bearing trees is a compromise, often sacrificing a few hundred pounds to build a strong tree architecture to reduce the risk of future tree failure. A good strategy seems to be to train the trees during the first two



Split scaffold poor training.



Standard long pruning.

years to 3-5 scaffolds and head them back enough to support their own weight when growth resumes the next year. The longer you leave the scaffolds, the less rank regrowth and the fewer root suckers you will have the following year. However, if you “long prune” the scaffolds, you will need to tie the limbs to lessen the risk of them breaking out later. After training your trees for one or two years, you can likely abandon pruning except to remove limbs that are in the way of equipment or present safety hazards for equipment operators.

Mechanical topping of young trees may offer a quick, relatively inexpensive way to reduce tree height, at least for one year. However, it appears that topping, just like all types of pruning, is an overall stunting process and likely reduces yield in many cases.

Special thanks to cooperating growers Robert Longstreth and Vikram Mahal.

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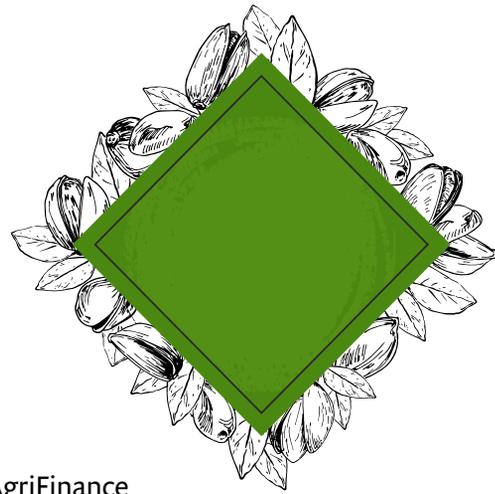
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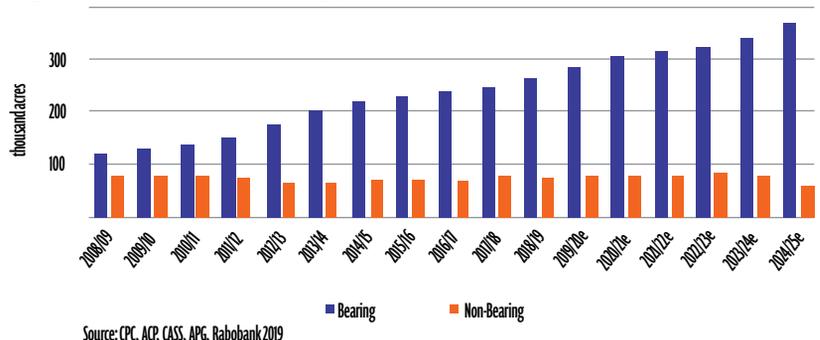
Pistachio Prices Hinge on Export Expectations



By DAVID MAGAÑA | Ph.D., Senior Horticulture Analyst for Rabo AgriFinance

OFF AND ON. THAT RHYTHM IS THE cadence for pistachio yields. On and on is what exports need to be. Last year two-thirds of U.S. pistachios crossed borders or sailed oceans. California producers have planted pistachio trees at a faster rate than any other tree nut variety over the last decade. Watching production grow, the RaboResearch team developed a supply-and-demand analytical tool to help growers anticipate prices levels for the next five years.

Figure 1. Baseline US Pistachio Acreage, 2008/09-2024/25e.



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Supply Growth is Set to Continue

Pistachio bearing acreage grew more than twofold over the last decade, making pistachios California's fastest-growing tree nut in terms of acreage. From 2024, bearing acreage will sit at about 370,000 acres—roughly a 40 percent increase (Figure 1). Industry estimates show that average pistachio net returns per acre exceed those obtained in competing nuts, creating incentives for new plantings.

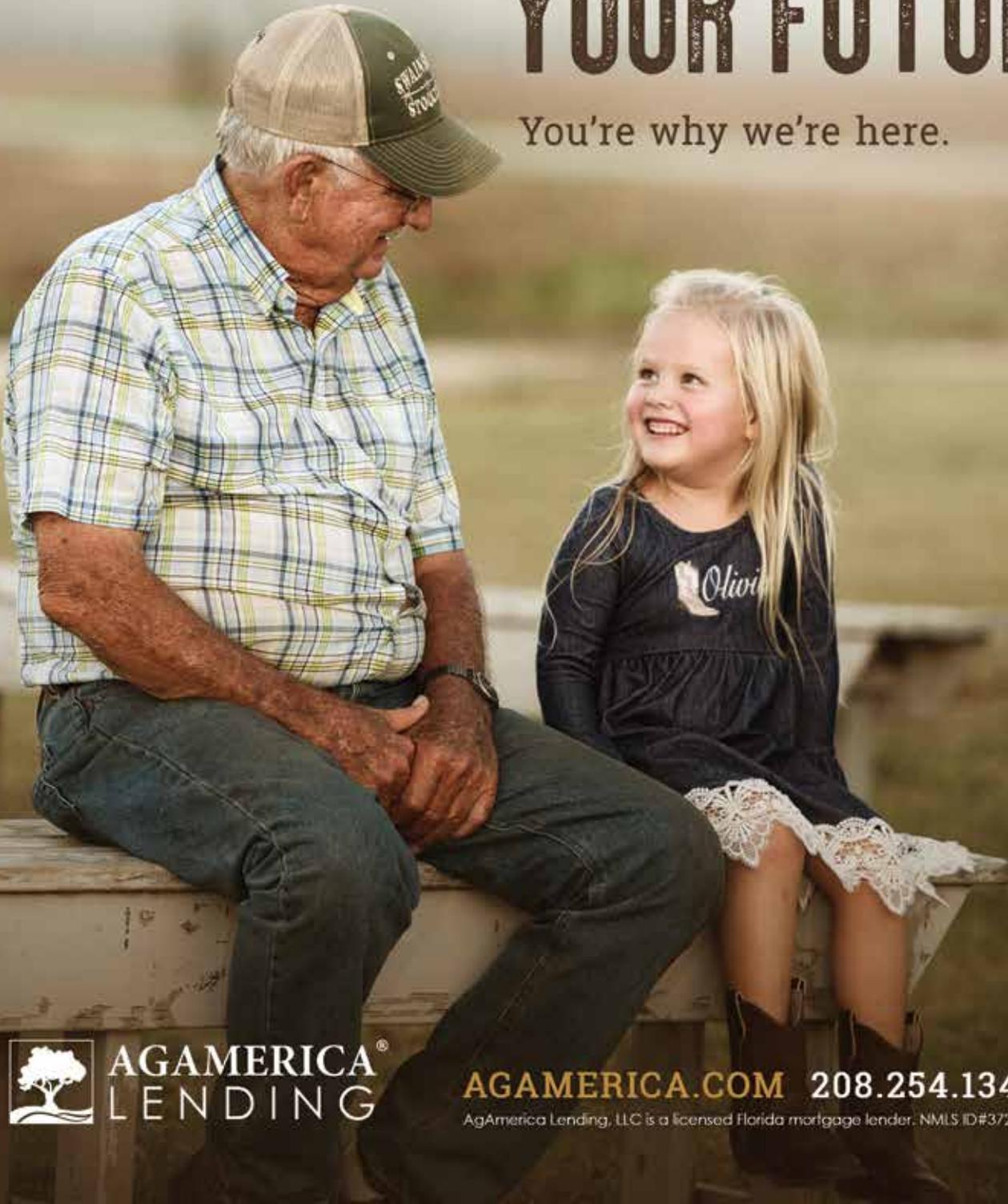
A relevant proportion of pistachio's planted acreage is located in the Southern San Joaquin Valley, a water-challenged area. The Sustainable Groundwater Management Act (SGMA) will limit future growth. For this reason, estimates indicate that non-bearing acres will remain stagnant for a few years and then decline by the end of the projection period. Yet bearing acres will be at record-breaking levels every year for the next several years.

After reaching a record crop in 2018, pistachio production in California is set to continue to grow. Rabo AgriFinance's market outlook, based on its pistachio supply-and-demand analytical tool, predicts that the 2019 crop will be the third-largest on record, while the 2020 crop should break the one-billion pound barrier. Moreover, pistachio production should reach new record levels in 2022 and 2024, as those are expected to be "on" years. Average yields will likely increase over the projected period as more trees reach maturity and full

Continued on Page 12

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production. The analysis takes yield variability into consideration and assumes there will be no interruptions to the alternate bearing nature of yields.

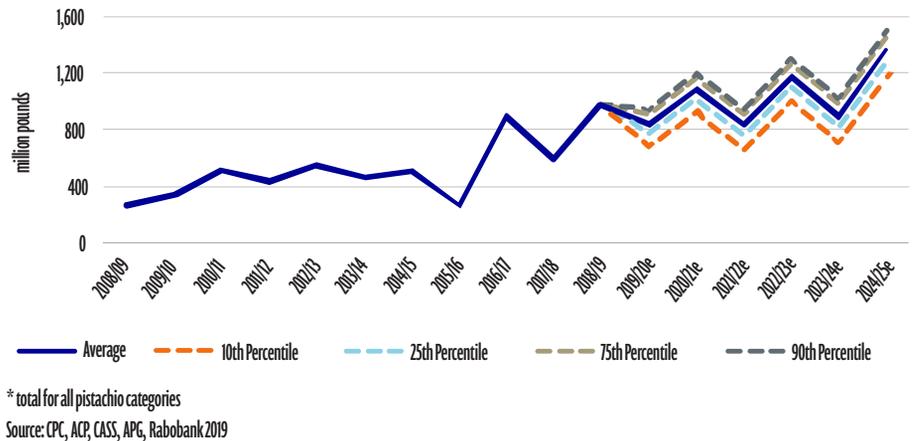
Whereas a colder spring may delay pistachio maturity this year, some expect this to be an exceptional “off” year. For 2019, the estimated average yield of about 2,900 lb/acre would result in an expected production of just below 850 million pounds. For 2024, the estimated average yield of about 3,700 lb/acre would provide expected production of about 1.37 billion (bn) pounds. Accounting for potential variability, Rabo AgriFinance estimates that there is a 50 percent probability that production will be between 1.29bn and 1.46bn pounds in 2024 (Figure 2).

Demand Growth Is Necessary

Demand continues to grow, as pistachios fit into the category of a healthful, convenient and tasty snack. China is the main export market for U.S. pistachios, followed by the European Union (EU) market. Despite trade concerns,



Figure 2. Baseline US Pistachio Production, 2008/09-2024/25e*



pistachio shipments during the 2018/19 marketing year continue at a strong pace. For several months, the U.S. industry took advantage of a raw vs. roasted pistachio tariff differential going into China (45 percent vs. 15 percent) by focusing on shipping roasted products. However, in the June 2019 retaliatory tariffs, China increased tariffs on U.S. processed pistachios, eliminating that option to avoid higher tariffs.

The potential negative effect of China's tariffs has been partially offset by less competition from Iranian product. Iran produced about 35 percent of global pistachio production in 2017/18, but extreme weather conditions severely impacted the 2018/19 Iranian crop—a 66 percent reduction year over year. Given the two-year cycle of pistachio (bud) development, some industry analysts expect the Iranian crop to still be down during the 2019/20 marketing year.

The U.S. is the leading pistachio-exporting country, usually accounting for about 60 percent of global exports. However, given the decline in Iranian exports, U.S. exports will make up about three-quarters of the world's pistachio exports in 2018/19.

U.S. exports to China, fostered by a fast-growing middle-class population, have grown fourfold over the last decade—from about 50 million pounds in 2008/09 to more than 200 million pounds in 2017/18. If tariffs on

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U.S. pistachios are removed after the 2019/20 marketing year, Rabo AgriFinance expects that exports to China will continue to grow, retaining the country's place as the main destination for U.S. pistachios.

Effective marketing campaigns and product differentiation seem to be fostering worldwide demand, too. Product innovation includes different package sizes, shelled pistachios, as well as non-salted or flavored pistachios. Marketing strategies—such as early shipping to make sure U.S. pistachios reach Chinese consumers before the Chinese New Year celebrations—have paid off, according to industry sources.

The industry has also been working on developing domestic demand. Per capita pistachio use in the U.S. has grown at a Compound Annual Growth Rate (CAGR) of about 8 percent during the last decade, to about 0.45 pounds per capita per year. While pistachio consumption lags behind almond's 2.3 pounds-per-capita use, there is plenty of room to grow.

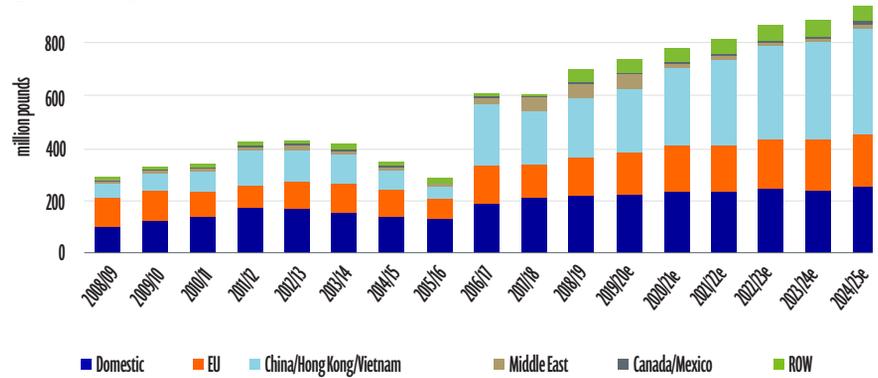
The composition of U.S. shipments has shifted considerably, as export shipments have grown faster than domestic shipments. During the 2000/01 marketing year, only about one-third of total shipments were exported. Currently, about two-thirds of U.S. pistachios are sold internationally. We expect this trend to continue over the next few years.

Rabobank expects total pistachio shipments to surpass 950 million pounds by 2024/25. **Figure 3** shows the average shipments broken down by main markets. Assuming tariffs by China are eliminated in 2020/21, there is an increase in shipments to the Asian market. On the other hand, shipments to the Middle East will decline starting in 2020/21, as the Iranian crop returns to normal levels (**Figure 3**).

As for ending stocks, the average estimate for 2018/19 is 180 million pounds. For the next few years, ending stocks will grow but should maintain manageable inventory levels under baseline conditions.

Continued on Page 14

Figure 3. Average Baseline U.S. Pistachio Shipments by Market, 2008/09-2024/25e*



*inventory adjustments/loss not included in the graph. Total for all pistachio categories.
Source: CPC, ACP, CASS, APG, Rabobank 2019

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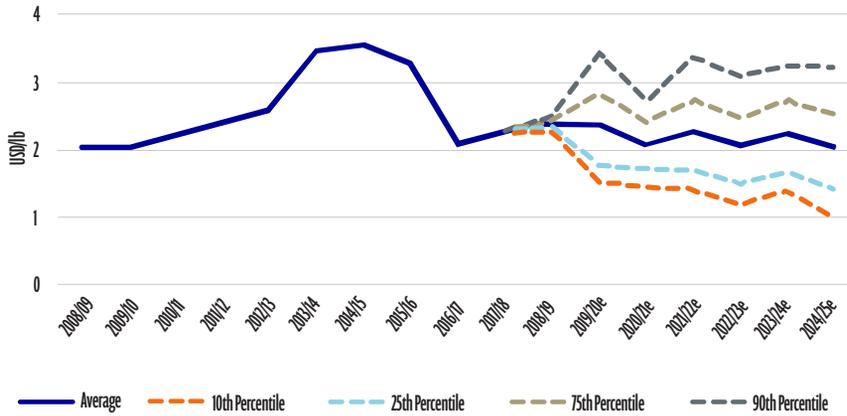
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Figure 4. Baseline U.S. Pistachio Returns to the Grower, 2008/09-2024/25e.



"With access to export markets unknown, producers need to do whatever they can to protect and grow demand."

Continued from Page 13

Average Expected Prices Aren't Too Shabby

Based on the average supply-and-demand expectations, average returns to the grower would range from \$2.05/lb to \$2.38/lb between the 2019/20 and 2024/25 marketing seasons. The price outlook for 2019/20 remains positive,

as reduced Iranian shipments would propel demand for U.S. product in export markets. As we look further out, prices show a slight downward trend, with some variation reflecting the alternating "on" and "off" years. For example, 2020/21 should be an "on" year, and there's a 50 percent chance of having farm prices between \$1.73/lb and \$2.43/lb (Figure 4). Depending on individual grower yields, there is a high likelihood that average blended prices will remain at profitable levels for most growers in California over the projection period.

But Things can Always get Worse... or Better

In the baseline analysis, Rabo AgriFinance assumes: 1. retaliatory tariffs for U.S. pistachios are lifted after the 2019/20 marketing year, and 2. the Iranian crop returns to normal levels in 2020/21, increasing export market competition, particularly in Middle Eastern countries.

Under the baseline scenario, Rabo AgriFinance estimates about a 26 percent chance of having a six-year average price above \$2.50/lb. The probability that the average price is between \$1.75/lb and \$2.50/lb is about 49 percent, while the probability of having an average price below \$1.75/lb is about 25 percent.

Now, let's look at two different scenarios. In scenario 1, Chinese tariffs remain in place and gray trade to China is enforced, adding tariffs to U.S. shipments going to Hong Kong and Vietnam. In scenario 2, Middle East demand for U.S. product holds, despite a return of the Iranian crop, while Chinese retaliatory tariffs are removed. In all scenarios, U.S. production assumptions remain the same.

Under scenario 1, access to the main market for U.S. pistachios is constrained by tariffs, and the chances of having a six-year average farm price above \$2.50/lb declines to about 16 percent, with increasing downside risk. The probability of having an average price below \$1.75/lb increases to about 48 percent.

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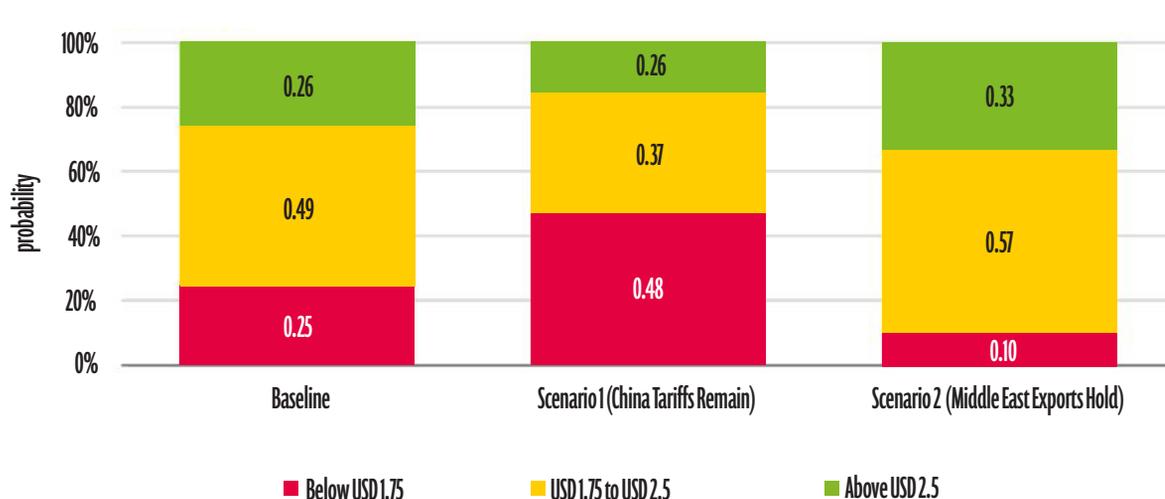


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Figure 5. Probability Ranges for U.S. Average Pistachio Farm Price, 2019/20-2024-25e, under Alternative Scenarios.



Source: Rabobank 2019

Under scenario 2 (the most optimistic one), exports to China and the Middle East continue to grow at the current pace, supporting prices. The probability of an average price north of \$2.50/lb increases to 33 percent, while the chances of having an average price south of \$1.75/lb declines to about 10 percent (Figure 5).

These scenarios show the critical relevance of maintaining access to international markets.

Downside risks on U.S. exports—and subsequently on U.S. price—include potential increased competition from other producing regions. For example, there are indications of rapid increases in Turkish pistachio production. The lower percentiles of the scenarios’ price estimates capture that possibility and other relevant risks, including extreme scenarios such as the recently announced intention of China to stop buying U.S. agricultural products.

Looking Ahead

The U.S. pistachio industry has performed well the last few years. With access to export markets unknown, producers need to do whatever they can to protect and grow demand.

Continue offering good-quality product and following strict food safety practices. On the marketing side, continued efforts are needed to capitalize on encouraging consumer trends, and to effectively market increasing volumes in order to maintain prices at profitable levels. Partnerships with key marketers and retailers have proven successful. Considering that pistachio per-capita use is still low compared to other tree nuts, there is plenty of room for this category to grow—both in the domestic and export markets.

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Figure 2. Flowering branch of Kester showing dense flower and spur production. All photos courtesy of Tom Gradziel.

Kester, A Productive Late Bloom Almond Variety from University of California Davis

By TOM GRADZIEL | Department of Plant Sciences University of California, Davis, CQA

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

THE VARIETY KESTER WAS developed as a pollenizer for Nonpareil that combines good kernel quality and productivity with a later flowering time for reducing vulnerability to flower diseases and frost damage. Kester's high productivity and later flowering time also make it a promising alternative to the variety Padre in Padre/Butte plantings. Kernels are similar to Nonpareil in shape and size, though the seedcoat tends to be darker and slightly rougher. The seed parent of Kester was Tardy-Nonpareil,

a bud-sport mutation of Nonpareil that retains Nonpareil's good kernel qualities and disease resistance but flowers 10 days after Nonpareil. The Kester tree is vigorous and upright to spreading, being similar to slightly smaller than Nonpareil in final tree size. Production occurs on a combination of spurs and terminal shoots. This growth habit supports high productivity with an open tree architecture that allows greater light penetration and air circulation to the canopy interior, thus reducing vulnerability to blossom, foliar and nut diseases.

Kester Evaluation

Kester was developed at the University of California Almond Breeding Program at Davis, California with long-term support from the Almond Board of California. The program was developed to breed new varieties and germplasm to meet the emerging needs of the expanding California industry. This includes the long-term, regional testing required to identify potentially serious problems in new variety releases before large-scale grower plantings. Towards this

goal, Kester has been evaluated for over 20 years in large scale Regional Variety Trials as well as a number of smaller grower trials in the northern and southern Sacramento Valley as well as the northern, central and southern San Joaquin Valley. During this 20-year regional evaluation, Kester showed no major vulnerability to important diseases and remain completely free of the genetic disorder Noninfectious Bud-Failure. Navel orangeworm damage was also consistently low. Nuts are well-sealed at maturity while providing a high kernel-to-nut crackout ratio. Kernels produced quality in-shell, raw and processed, (including blanched and roasted), product. The occurrence of undesirable kernel types, including double-kernels and kernels having multiple

DURING THIS 20-YEAR REGIONAL EVALUATION, KESTER SHOWED NO MAJOR VULNERABILITY TO IMPORTANT DISEASES AND REMAIN COMPLETELY FREE OF THE GENETIC DISORDER NONINFECTIOUS BUD-FAILURE.

embryos was also low, being similar to Nonpareil.

Utilizing Tardy-Nonpareil to Delay Bloom

Utilizing the Tardy-Nonpareil

budsport as a parent was successful in delaying bloom time by approximately one week while maintaining good kernel quality and productivity. Bloom

Continued on Page 18

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Continued from Page 17

begins approximately three days before Nonpareil full bloom in the different Sacramento and San Joaquin Valley growing regions, with full bloom for Kester occurring approximately six days after Nonpareil. Petal-fall typically occurs a week after Nonpareil petal-fall, providing good late-bloom overlap.

Bloom period, including start of bloom, full bloom and petal-fall in the different growing regions was very similar to that of the Butte variety. Like Nonpareil and Butte, Kester is self-sterile but cross-compatible with Nonpareil, Butte, and most major Nonpareil pollenizers. Harvest occurs just after



Figure 1. Appearance of in-shell nuts and kernels of Kester compared to Nonpareil.

Cultivar	Nuts/tree	Kernel mass (g)	Kernel/nut ratio	Kernel lbs./tree	Kernel lbs./acre	Cumulative (2006-12) kernel yield (lbs./acre)
Nonpareil	8855 a	1.18 b	0.70 a	22.5 a	2718 a	20910 a
Kester	7617ab	1.19 b	0.69 a	20.1 b	2432 b	20270 a
Winters	8679 a	1.01 c	0.62 ab	19.3 b	2338 b	17095 b
Sweetheart	8653 a	1.10 c	0.60 ab	21.0 ab	2538 b	16456 b
Marcona	6449 b	1.22 b	0.28 d	17.4 c	2104 c	13351 c
Chips	9008 a	0.92 d	0.65 ab	18.2 bc	2201 bc	16416 b
Kahl	8830 a	1.05 c	0.55 bc	20.4 b	2465b	15979 b
Kochi	2025 c	1.41 a	0.51 c	6.3 d	763 d	12816 c

Table 1. Averaged 2010-2012 mature-tree production data for Kester compared to Nonpareil and pollenizer cultivars in the planting in Kern County. Cumulative (2006-12) kernel yield presented in last column. (Scores within columns followed different letters are statistically different using a Duncan's multiple range test with P equals 0.05.)

	Alternaria	Hull Rot	Scab
Nonpareil	0.1 a	6 b	0 a
Kester	0.5 bc	2 a	0 a
Kochi	0.3 ab	25 c	0.2 a
Chips	0.5 bc	3 a	0 a
Marcona	0.8 cd	0 a	0 a
Sweetheart	1 de	1 a	0 a
Kahl	1.3 e	0 a	0 a
Winters	3.0 f	2 a	2.2 b

Table 2. Scab and Alternaria leafspot rating, and hull rot strikes per tree following unusually high disease pressures in 2012 at the Kern County plot. (Scores within columns followed different letters are statistically different using a Duncan's multiple range test with P equals 0.05.)

BLOOM PERIOD, INCLUDING START OF BLOOM, FULL BLOOM AND PETAL-FALL IN THE DIFFERENT GROWING REGIONS WAS VERY SIMILAR TO THAT OF THE BUTTE VARIETY.

Nonpareil and before Monterey and other mid-to-late season varieties, thus allowing more efficient use of harvest equipment.

Evaluating Yield Potential

To accurately evaluate yield potential, Kester, Nonpareil and several pollenizers were evaluated in a replicated grower trial in the southern San Joaquin Valley. Trees were planted in 2004 on Hansen rootstocks in Kern County near McFarland, California. Soils consisted of McFarland loam and Wasco sandy loam which are both Class I soils. The irrigation system was double line drip. Standard tree spacing of 20 feet between tree rows and 18 feet between trees were used for a density of 121 trees per acre. Pollenizers alternated with Nonpareil rows throughout the orchard with all trees grown under standard commercial practices.

Data was collected from 2005 to 2012 for bloom and harvest time, nut yield and quality, and disease and insect damage. The combination of good overlap with later Nonpareil bloom, open tree architecture, high flower-density, and cross-compatibility with Nonpareil and its pollenizers resulted in consistently high productivity over the eight years of evaluation. A high crop density, however, makes the variety vulnerable to alternate-bearing if sufficient nutrients and water are not provided for development of the current season crop as well as the flower bud development for next season's bloom.

Mature trees under heavy production showed low to moderate susceptibility to scab, Alternaria leafspot and hull rot. The thin 'paper-shell' of Kester conferred a high crack-out ratio of 0.69 while a good shell-seal limited damage by navel orangeworm to under six percent for all test years. These characteristics also made Kester a useful pollenizer for mid-to late season varieties, including Butte plantings where it has been planted as an alternative to Padre. [Detailed, multi-year data can be found in annual Field Evaluation of Almond Varieties research reports available at the Almond Board of California website].

Foundation Trees

Virus-free and certified true-to-type foundation trees have been established at the Foundation Plant Services Clean Stock Facility at Davis, California to provide registered budwood to nurseries. The name Kester was chosen to acknowledge the extensive contributions to almond variety and rootstock

improvement by Professor Dale Kester during his career in the Department of Pomology at the University of California at Davis.

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MYCORRHIZAL FUNGI HAVE BENEFITS IN AGRICULTURE

Mycorrhizal fungi and plants have a mutually beneficial relationship.

By CECILIA PARSONS | Associate Editor

Cover crop in alley. Photo courtesy of Cecilia Parsons.

RESearchers who are exploring this relationship are finding that mycorrhizal fungi are a vital part of ecosystem health around the world—not only in less intensively managed ecosystems but in agricultural landscapes as well.

Mycorrhizal Fungi

Mycorrhizal fungi colonize the root system of a host plant to form a symbiotic relationship and assist with water and nutrient acquisition. In return, the plant provides the fungus with energy in the form of carbohydrates, or sugars. In addition, these microscopic fungi may also play an important role in minimizing the impacts of stress and disease on plant hosts.

Mycorrhizae exist as microscopic threads called hyphae and, when bunched together in a mass, form a net-like structure called mycelium that continues to grow and explore the soil. The mycelium of a single mycorrhizae can extend out to connect

multiple plants or connect with other mycorrhizae to form a huge underground web called a common mycorrhizal network. As these networks extend throughout the soil, they start to play a role in supporting important agricultural services related to soil structural maintenance, water dynamics, nutrient cycling, and disease suppression.

Fungal Hyphae

Plant roots can gain access to soil water and nutrients via associations with mycorrhizal fungi through direct links between root and fungal cells. Roots need to be in direct contact with soil to access water and nutrients and, in some cases, can be restricted because of compacted soil conditions. Fungal hyphae, which are much smaller than plant roots, can improve access to soil nutrients and water for plants by exploring more extensively throughout the soil profile and obtaining nutrients and water from smaller soil aggregates. In fact, plants with mycorrhizal colonization have 50-100 times more nutrient reserves available than a non-colonized plant. Fungi also decompose more complex organic compounds that are then made available in simpler forms to other soil organisms, such as microbes, that perform additional services. Mycorrhizal fungi thus play an invaluable role in supporting plant health and growth, both of which are essential to agricultural productivity.

Impacts to Soil Health

Although mycorrhizal fungi play an important role in both maintaining soil structure and improving plant health and growth, agricultural activities—including tillage, nutrient applications, fumigants, and anaerobic soil conditions—can significantly impact overall soil health and the fungal communities that rely on good soil conditions. This ultimately impacts the fungal community's ability to provide the services with which crops rely on. Given that most crops can form associations with mycorrhizal fungi and that there are many benefits of interest for agricultural productions, it is imperative that we better understand how to create soil environments that support fungal communities and services.

As the importance of microbial communities, including fungi, have become an increasingly popular topic in agriculture, focus has turned to how management of our soils and crops impacts the soil ecosystem and, subsequently, the capacity for the soil to provide ecological and production benefits. University of California, Davis, plant sciences researchers



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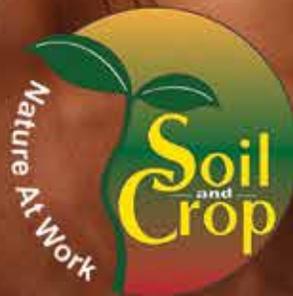
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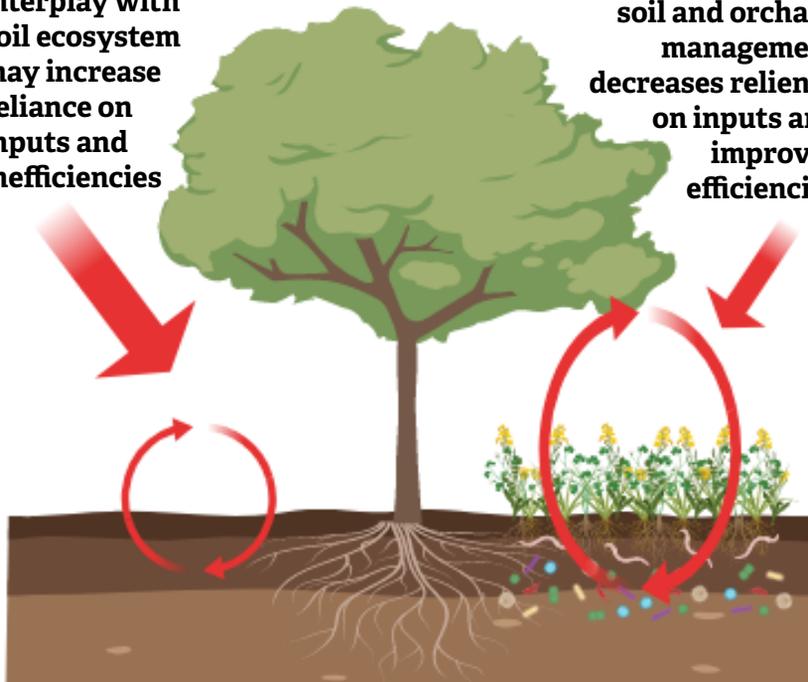
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Interplay between soil and orchard management decreases reliance on inputs and improves efficiencies



Cover crops to add farm scale biodiversity and are increasingly being incorporated into management as a means to foster more sustainable, resilient, and productive agricultural systems. Photo courtesy of Krista Marshall.

Continued from Page 20

Amélie Gaudin and Astrid Volder, have been investigating the nature of the symbiotic connection between mycorrhizal fungi and almond tree roots to determine the potential of mycorrhizal fungi inoculation to reduce water stress.

Soil Health Building Principles

A University of California (UC) Davis graduate student, Krista Marshall, who is working with Dr. Gaudin, said soil health building principles aim to minimize soil disturbance, maximize organic inputs, increase the amount of living roots and soil cover, and improve farm scale biodiversity are increasingly being incorporated into management as a means to foster more sustainable, resilient, and productive agricultural systems.

Management practices that recognize the importance of soil health have shown potential to improve services such as water conservation, nutrient use efficiency and yields while reducing soil erosion and leaching potential and improving soil organic matter and biodiversity—most of which are underpinned by the microbial communities that exist in the soil.

Research

Marshall is currently working on a research project surveying 13 orchard blocks that represent a diversity of practices to better understand how soil management impacts microbial community characteristics and the services mentioned above. Healthy soils are indispensable to microbial communities, including mycorrhizal fungi, and should be a consideration in orchard management decision-making, Marshall said. “It’s like a domino effect: the healthier the soil, the better the conditions for hosting more robust and diverse microbial communities, the more potential there is for better functioning and provision of agricultural services for crop productivity and sustainability.”

Mycorrhizal Inoculations

Mycorrhizal inoculations—which are quickly becoming of interest across the agricultural community—are being explored as a means to reap the benefits of

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the symbiotic associations between fungi and plants. The active components in the inoculum are mycorrhizal fungi propagules in the form of spores and colonized root fragments. When one of these colonizing units touches or comes into very close proximity with living root tissue, they are activated by minute amounts of specialized root exudates and begin the colonization process.

Growers who are interested in using mycorrhizal inoculants in their production systems need to evaluate the current need for an inoculation as well as the soil health status of their orchard. It is also helpful to work with extension advisors or commercial suppliers and others who are familiar with mycorrhizal fungi to make sure cultural and management changes can improve the current mycorrhizal status or whether inoculation is warranted.

If use of an inoculant is warranted, the next step is to assess the different products on the market. Aspects of the products to consider include:

- 1) Purpose of the product and how to use it
- 2) Content of the product including specific species
- 3) Guarantee of a pathogen-free content
- 4) Mycorrhizal effectiveness in a standard test
- 5) Maximum dilution of content
- 6) How to store
- 7) Recommended date of use

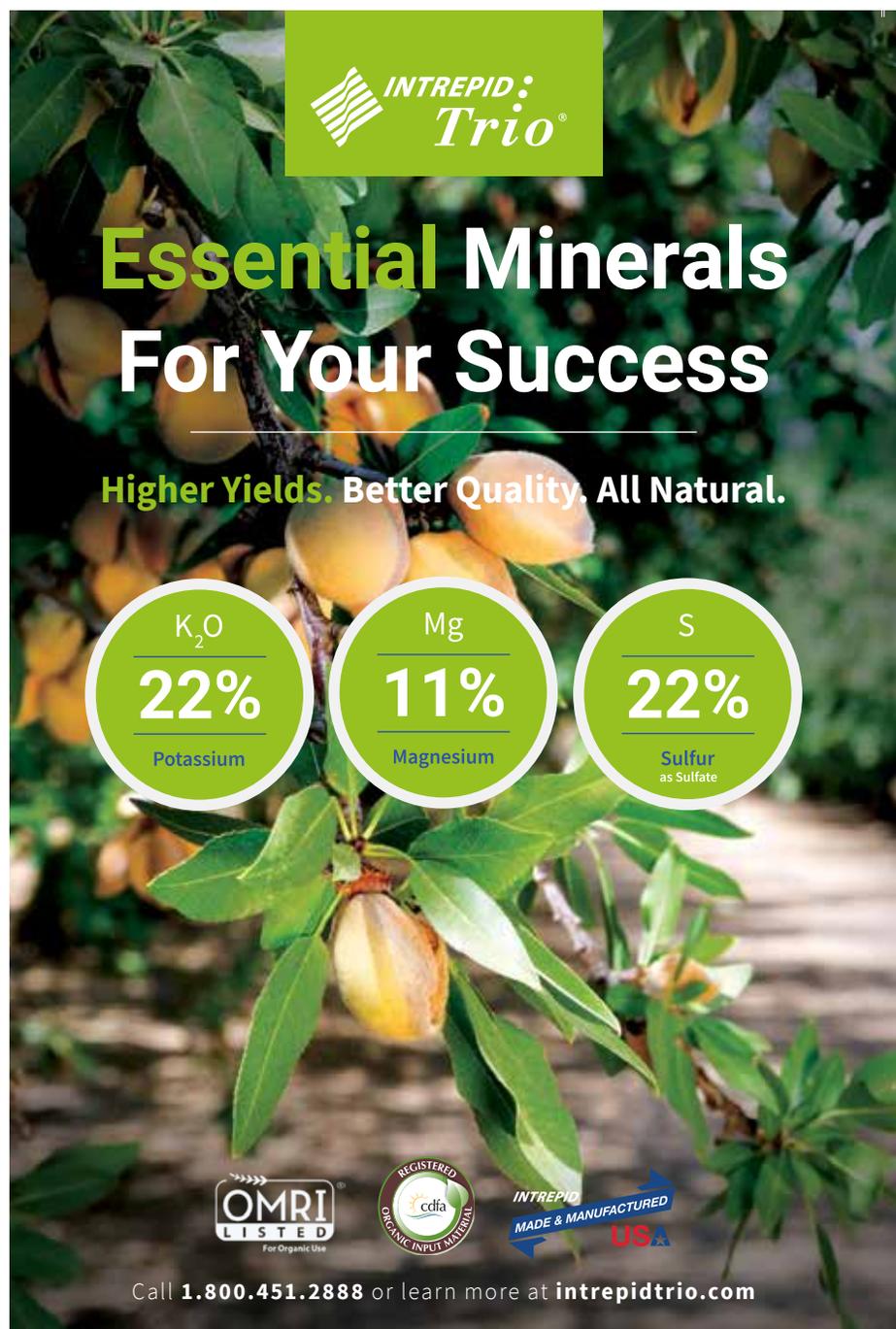
The inoculum products can be tested on a small scale using non-inoculated plants as a comparison.

The use of commercial inoculants is being presented as a means to more quickly and effectively restore mycorrhizal populations. However, Marshall points out that, “there is no definitive research suggesting that these inoculants are effective and management should aim to improve the soil ecosystem in which

these microbial communities live”. To a similar effect, Carolyn Scagel from the United States Department of Agriculture (USDA)/Agricultural Research Service(ARS)/Horticultural Crops Research Laboratory in Corvallis, Oregon, suggests that mycorrhizae present in the soil, or applied as an inoculant, will not solve all production problems. Excessive tillage, fumigant applications, or nutrient imbalances can greatly affect microbial communities and activity in the soil. For example, USDA/ARS research shows that

compost, compost teas, no-till, humates, seaweed extracts and fish fertilizers, in diverse and various ways, increase microbial activity in soil. Therefore, if growers are interested in using these inoculants or improving the native microbial populations present in their soil, they must also utilize practices that improve orchard soil health.

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38 Year UCCE Farm Advisor Janine Hasey Retires

By CECILIA PARSONS | Associate Editor



ONE OF JANINE HASEY'S FIRST duties as a University of California Cooperative Extension (UCCE) intern was to lead a meeting for walnut growers and explain what was causing blackline disease in their orchards.

"There was a great turnout of about 100 people," Hasey recalled. "My mentor and great pomologist, Dave Chaney, let me run the meeting. This was going to be the first local meeting on what caused the disease."

Blackline disease, she told growers at the meeting, is caused by cherry leafroll virus and spread from tree to tree with infected pollen. That meeting not only launched a 38-year career as a UCCE advisor in Sutter and Yuba counties for Hasey, but also sparked a long-time commitment to help walnut growers become more productive and profitable.

Dedication

Growers, fellow farm advisors and researchers have agreed that Hasey's dedication to finding solutions for production problems led to numerous improvements in walnut rootstock development, disease control, pest control, irrigation management, pruning and numerous other production practices.

Collaborative Research

Through collaborative research, Hasey said, she sought to deliver reliable information to growers that would help them make planting and management decisions. She emphasized that throughout her career, the research was almost

always a true collaborative effort with fellow UCCE, University of California (UC), and United States Department of Agriculture (USDA) colleagues, growers, and nurseries.

Hasey said the seriousness of blackline disease in walnuts at that time pushed efforts to find new rootstocks that were tolerant to the disease and would allow orchards to be planted where blackline was a production challenge. She did field testing with walnut breeding pioneers including Gale McGranahan on rootstocks as well as on new varieties. Clonal propagation of English walnut and walnut rootstocks using tissue culture was just beginning back in the 1980's. Walnut is difficult to clonally propagate, she said, but McGranahan believed that using this method to develop own-rooted English trees could help growers overcome problems with blackline. They also experimented with cloning rootstocks setting the stage for elite clonal testing in the early 2000's for rootstock tolerance or resistance to nematodes, Phytophthora, and crown gall. By 1987, Hasey had a rootstock trial in Rio Oso that included several black walnut species and one of the first with clonal Paradox. Even back then she observed less crown gall on the clonal Paradox compared to the seedling Paradox rootstock, a trend we see today with our clonal rootstocks.

Own-Rooted English Walnut Trees

"After the cause of blackline was determined by Dr. John Mircetich, we really weren't sure how fast the disease

would continue to spread in the early 1980's. That's how I got interested in own-rooted English walnut trees", Hasey said. Being all English with no rootstock, these clonal trees don't die from blackline disease like when English are grown on black or Paradox rootstock. By 1991, Hasey planted the first own-rooted Chandler trial at the Whitney Warren Ranch in Rio Oso with trees provided by researcher John Driver who propagated them from cultures of English walnut from the McGranahan lab. In this replicated trial they were able to compare these with seedling Paradox rootstock over an 11-year period.

Hasey subsequently led additional replicated trials, surveys and screening studies that allowed her and fellow researchers to determine own-rooted English walnut susceptibility to nematodes, disease, and environmental factors. This allowed them to help growers determine if these trees are suitable to their sites in areas where blackline is prevalent. One survey looked at every own-rooted English walnut tree in the field for crown gall incidence which they found to be very low.

Walnut grower Brent Barton of San Joaquin County is one of the many growers who have benefitted from Hasey's and her colleagues' research. Based on their field trials, Barton and others were able to make planting decisions to overcome challenges for their growing areas. Due to the blackline issue

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in that area, using own-rooted English trees in good soils proved to be the best choice.

Hasey noted that the concern back in the early 80's that blackline would become a significant problem in all walnut growing counties fortunately has not been the case. The same area in her counties where blackline was most prevalent back then still is and it has remained at about the same low levels in most walnut growing counties outside the major impacted Delta and coastal regions over her career.

Emerging Trends in Cropping Patterns

Hasey's work also pointed out an emerging trend in cropping patterns to help the industry plan for long term increases in production. During a sabbatical leave in the early 1990s, she published, "Maintaining the Competitive Edge in California's Walnut Industry" a long-term strategic plan for land use and production in walnut through the UC Davis Ag Issues Center. This publication grew from interviews with every walnut advisor in the state and county agricultural commissioners in counties where walnuts were grown. It evaluated land use and cropping patterns and projected that there would be a conversion to tree crops including walnuts in many areas where field crops were grown in several counties. By the early 2000s and continuing, the predictions were proven true.

New Challenges

New challenges to walnut production over the years that Hasey became involved in included pistillate flower abscission, higher incidence of crown gall, the spread of *Botryosphaeria* in walnuts, flood and drought effects on production, frost damage, thousand cankers disease, and walnut replant disease.

David Ramos, UC Davis walnut specialist emeritus, said Hasey was one of the key extension advisors involved in not only rootstock development, but in training and pruning walnuts.

"She was a valuable link in bringing walnut grower needs to the attention of UC researchers and played a lead role in



At a 2018 walnut field meeting at Sierra Gold Nursery, Janine Hasey and Luke Milliron speak with growers. Photo courtesy of Melissa Steidlmayer.

field trials for rootstocks. We could not have done that without her," Ramos said.

Rootstock Research

Hasey has been the lead advisor on clonal Paradox rootstock research trials throughout the state that are testing new disease resistant genotypes bred by USDA, UC, and UCCE researchers with funding through the Federal Specialty Crop Research Initiative (SCRI) grant and the California Walnut Board. The new genotypes are being compared to our standard clonal Paradox RX1, VX211, and Vlach that were cloned and screened in the early 2000's and have been adopted by many growers to deal with site specific problems. As a farm advisor emeritus, Hasey plans to continue to oversee these rootstock plots and work with the newer walnut advisors.

The next generation of UCCE advisors is now poised to continue rootstock research to help growers' specific needs in the field.

One of those UCCE advisors is Luke Milliron, an orchard systems advisor in Butte County who counts Hasey his mentor.

Hasey's Impact on Walnut Production

Her impacts on local walnut production have been tremendous, Milliron said, noting her leadership following the 2017 flooding that left many acres of walnuts standing in water for months. Hasey's work in training young walnut trees and pruning has also contributed to the industry.

"She brought a wealth of skills and an

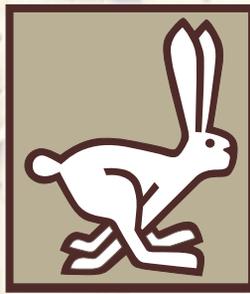
immense repository of knowledge to farm visits and field diagnosis. Hasey's example of cutting through to address the most critical needs faced by her growers has been the greatest mentoring of all. I am incredibly thankful not only to have her as my mentor, but to have her on speed dial for my next tough field diagnosis."

Ramos also noted that Hasey entered her career with UCCE at a time when there were very few women farm advisors.

"As one of the first woman farm advisors in California, there was concern that the growers might not accept her, but she became one of the top advisors in the state. She is a remarkable role model for women who want to become farm advisors."

Hasey noted the many changes in the walnut industry including Chandler now being well over half the statewide production from just a few orchards at the beginning of her career, along with clonal rootstock development and the several nursery products now available to growers. Perhaps the biggest change in walnut culture she has witnessed though was discovering through our UCCE research, that we don't have to prune using heading cuts on lateral bearing walnut scaffolds to keep them growing during the training stage. This was a major paradigm shift in walnut production that can save growers costs on labor and brush removal and often results in increased early production.

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C O N F E R E N C E



Full Menu of Workshops and Seminars

The inaugural Crop Consultant Conference will be a gathering place for all who are dedicated to caring for California specialty crops.

By CECILIA PARSONS | Associate Editor

PEST CONTROL ADVISORS (PCA), CERTIFIED Crop Advisors (CCA), applicators and agriculture retailers are all invited to participate in this two-day conference, September 26-27 in Visalia.

This event at the Visalia Convention Center packs a full menu of educational workshops and seminars, professional networking opportunities plus multiple hours of PCA and CCA credits into 24 hours. The program begins at 1 p.m. on Thursday and concludes after lunch and a final speaker, at 1 p.m. on Friday.

The workshop and seminar topics at the CCC have been chosen to help all crop advisors keep informed about new regulations, pest and disease control and management updates, label information and new technologies. In addition to the educational component, this conference will feature an early evening mixer and networking opportunities to be followed by a full gala dinner and entertainment.

Why Attend?

“Where else can a PCA or CCA get that many hours of credit, receive useful information plus meals and entertainment and not have to drive long distances?” says Jason Scott, publisher

of West Coast Nut, Progressive Crop Consultant and Organic Farmer magazines and host of this conference.

“This event is right in their back yard, where specialty crops addressed in this conference, are grown. It is designed to present the ‘big picture’ of specialty crop production, innovative technology, regulations, and challenges here in California,” Scott added.



Jason Scott, Publisher,
West Coast Nut.

Citrus

Greg Douhan University of California Cooperative Extension (UCCE) area citrus advisor for Tulare, Fresno and Madera counties, said the conference will be a valuable forum to communicate important research and information regarding many aspects of various crops grown in California. Agriculture industry personnel, PCAs, CCAs, and so on and so forth, benefit from these meetings tremendously to keep abreast of the latest challenges that face California Agricultural producers.

Douhan, whose territory includes a major portion of California’s citrus belt, will be one of the featured conference speakers and will present current information on HLB and Asian Citrus Psyllid management.

Aerial Drone Technology

A presentation on aerial drone technology is also expected to drive attendance.

Mark Dufau, director of Business Development for AeroVironment, will speak on optimizing integrated pest management (IPM) and nutrient management using drones.

Agronomist Nick Canata with Ingleby USA/Eriksson LLC of Visalia reports that the CCC agenda looks interesting, especially the drone technology presentation. His company,



he added, is presently using aerial flyovers to obtain irrigation information.

Mating Disruption

Crop advisors who are evaluating their mating disruption choices will hear a panel of experts that includes United States Department of Agriculture (USDA) researcher Chuck Burks, Dani Casado chemical ecologist with Suterra and Peter McGhee, research entomologist with Pacific BioControl Corp. This panel will evaluate mating disruption as part of an IPM program.

Soils

Thursday's program starts on the ground with sustainability specialist Richard Kreps who will explain how to get the most out of your soils.

Kreps, with Ultagro, said making soils work at an optimal level requires a quite a bit of dedication. Attacking it from all sides: amending, nutrition applications, increasing organic matter, biology and proper irrigation require a lot of coordination. The upside is orchard longevity, higher returns with less disease and pest pressure.

Paraquat Guidelines

Thursday's education agenda ends

with new EPA guidelines for 2020 for Paraquat closed transfer system. Speaker will be Charlene Bedal, West Coast regional manager with Helm AGRO US.

Trade Show and Mixer

The conference mixer and trade show begin at 5 p.m. Thursday, and dinner will be served at 6 p.m. The keynote speech will be Trécé on NOW Monitoring and Management – Current and Future Trends. At 7, Las Vegas entertainer and illusionist Jason Bird will perform. One of the most innovative and prolific minds in the magic industry, Bird continuously advances the boundaries of his craft while making connections with his audiences. Bird will also perform small group illusions during the trade show/mixer.

Friday

Friday morning's agenda kicks off at 7 a.m. with breakfast and a presentation by Patty Cardoso of Gar Tootelian on keeping growers compliant with local and state regulations. The trade show opens at 7:30.

Friday's topics include A New Approach to IPM by Surendra Dara, UCCE entomologist; a panel discussion major crop pests affecting specialty crops; and an update on labels.



Botryosphaeria on walnut. Photo courtesy of Cecilia Parsons.



Checking for NOW larvae. Photo courtesy of Cecilia Parsons.

To register for this event and see a complete agenda, go to progressivecrop.com/conference/wcn

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EMERGENCY WILDFIRE SMOKE REGULATION ADOPTED

THE IMPACT TO EMPLOYERS

By AMY WOLFE | MPPA, CFRE, President and CEO, AgSafe

WE ARE ALL AWARE THAT California has been ravaged by wildfires in recent years. The loss of life and property has been historical and has meaningfully changed how some in our agricultural community operate. Politically, a variety of issues exist surrounding how to take both preventative and corrective measures in all aspects of wildfire management. One of those areas of consternation that has been a point of discussion for nearly a year is the impact of wildfire smoke on employees.

In December 2018, the California Labor Federation, Worksafe and the California Rural Legal Assistance Foundation filed Petition No. 573, “requesting development of an emergency standard to put in place protections for outdoor workers who are working in areas impacted by wildfire smoke.”ⁱ Of particular concern by the petitioners is workers’ exposure to fine particulate matter (PM2.5), which wildfire smoke contains unhealthy levels. “Exposure to fine particulate matter can

reduce lung function, worsen heart and lung conditions, and cause coughing, wheezing and difficulty breathing.”ⁱⁱ

As is customary, California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA) staff reviewed the evidence supporting Petition No. 573 and their findings, in addition to the information provided by the petitioners was reviewed by the Occupational Safety and Health Standards Board (Cal/OSHA Standards Board). The Board determined on March 21, 2019 to grant in part Petition No. 573 and what followed was a whirlwind of activity by Cal/OSHA staff and stakeholders.

Less than two months later an advisory committee meeting was held for all parties to provide input and feedback as to the impact of wildfire smoke on employees, the possible control measures in a standard, the feasibility of the new regulation, and the cost. An exhaustive comment period was held

Continued on Page 32

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on May 8, 2019 and as a result, Cal/OSHA staff further refined the proposed regulation to take into account the perspective shared.

On July 18, 2019, the Cal/OSHA Standards Board adopted the final regulation. Under the emergency rulemaking process, the regulation takes effect ten days following the languages submission to the Office of Administrative Law. Cal/OSHA officially announced the regulation took effect on July 29, 2019, indicating no delay or issues found by the Office of Administrative Law. This regulation will be effective for one year and during that time, Cal/OSHA intends to pursue the development of a permanent regulation for the protection of employees from exposure to unhealthy levels of wildfire smoke.

The Devil is in the Details

After all the whirlwind political wrangling to bring the emergency regulation

to fruition, the question is now who is impacted and what action ensures compliance? The emergency regulation applies to workplaces where the current Air Quality Index (AQI) for airborne particulate matter (PM) is 151 or higher, and where employers should reasonably anticipate that employees could be exposed to wildfire smoke.

Certain workplaces have been exempted from the regulation and those include:

- Enclosed buildings or structures in which the air is filtered by a mechanical ventilation system and the employer ensures that windows, doors, bays, and other openings are kept closed to minimize contamination by outdoor or unfiltered air.

- Enclosed vehicles in which the air is filtered by a cabin air filter and the employer ensures that windows, doors, and other openings are kept closed to minimize contamination by outdoor or unfiltered air.

- The employer demonstrates that the concentration of PM2.5 in the air does not exceed a concentration that corresponds to a current AQI of 151 or greater by measuring PM2.5 levels at the worksite.

- Employees exposed to a current AQI for PM2.5 of 151 or greater for a total of one hour or less during a shift.

- Firefighters engaged in wildland firefighting.

For those employers not exempt from the standard, the following steps must be taken to mitigate workers' exposure:

- Identify harmful PM from wildfire smoke before each shift and periodically thereafter by checking the AQI for PM 2.5 (the pollutant of concern).

- Reduce the exposure by relocating workers to an enclosed building with filtered air or move workers to another outdoor location where the AQI for PM 2.5 is less than 150.

- If you cannot move workers out of the area with the AQI reading in excess of 151, then you must provide:

- Respirators, such as N95 masks, for voluntary use.

- Training on the new regulation, the health effects of wildfire smoke, and the safe use and maintenance of respirators.

One of the requirements for an employer to comply with the new emergency regulation protecting workers from wildfire smoke exposure is to provide respirators, such as N95 masks, for voluntary use once the AQI reading is in excess of 151 for more than an hour or more during a shift.





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It is important to remember that while the decision to use the respirator is that of the employee, you as the employer must always make them available and ensure workers are trained in how to properly use them. If the employee opts to not wear the mask, it is recommended that he/she signs documentation acknowledging that training was provided and the

protection was offered, and it was his/her decision not to use the personal protective equipment.

To review the complete text of the regulation, visit <https://www.dir.ca.gov/OSHSB/documents/Protection-from-Wildfire-Smoke-Emergency-txtbrdconsider.pdf> It is also important for employers to remember that this story is not complete. On August 27, 2019, Cal/OSHA is convening an advisory committee meeting to begin the process of developing the permanent standard. Compliance with the emergency regulation will play a critical role in that process and as always, agricultural stakeholders are encouraged to provide input into the impact of the regulation.

For more information about workplace safety during a wildfire or other natural disaster, or other 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. AgSafe is a 501c3 nonprofit providing training, education, outreach and tools in the areas of safety, labor relations, food safety and human resources for the food and farming industries. Since 1991, AgSafe has educated over 85,000 employers, supervisors, and workers about these critical issues.

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



N95 Mask 1 and N95 Mask 2 (Source: Amazon)

¹Mitch Steiger, Douglas L. Parker, Anne Katten, "Petition 573," California Department of Industrial Relations, Division of Occupational Safety and Health, July 25, 2019, <https://www.dir.ca.gov/oshsb/documents/petition-573.pdf>.

²Mitch Steiger, Douglas L. Parker, Anne Katten, "Petition 573," California Department of Industrial Relations, Division of Occupational Safety and Health, July 25, 2019, <https://www.dir.ca.gov/oshsb/documents/petition-573.pdf>.

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Wildfire Response Legislation Passes— What Does it Mean?

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

IN RESPONSE TO THE CATASTROPHIC WILDFIRES

California has experienced over the past two years related to power lines, this past month the State Legislature passed AB 1054 (Holden) and it was subsequently signed a few days later by Governor Gavin Newsom. So what does it mean to ratepayers, in particular farms, hullers and processors of tree nuts throughout California? First, let me state that it is not everything that should have happened. Rather, it is probably the best we could ask for given the makeup of this state and the state legislature. To think that ratepayers have to pay anything is outrageous. Given the fact that Pacific Gas and Electric (PG&E) has some 18,500 miles of transmission lines they know are outdated, including lines that are 98 years old such as the one that caused the Camp Fire, how, or why,

are ratepayers on the hook for any of this? Especially, given that PG&E has doled out over \$5 billion to shareholders that should have been used to fix some of the problems. To make matters worse, PG&E is now reporting they have now identified over 10,000 problems in their current power lines. This legislation doesn't solve these problems, but it does offer some protections going forward.

AB 1054

First, it provides some significant safety upgrade requirements and oversight. AB 1054 requires PG&E, Southern California Edison (SCE) and San Diego Gas & Electric (SDC&E) to make \$5 billion in safety investments, otherwise known as “system hardening”. This \$5 billion is spent without the normal return on equity that the utilities normally receive, saving ratepayers hundreds of millions of dollars. It also creates an oversight board known as the California Wildfire Safety Advisory Board (CWSAB) that consists of seven members to advise and make recommendations related to wildfire safety for both independent investor owned utilities (IOUs) and public owned utilities (POUs).

This legislation also clarifies an issue over the standard used to determine whether a utility can recover costs arising from a covered wildfire. Specifically, it allows cost recovery if the costs and expenses are determined just and reasonable based on reasonable conduct by the utility. It considers factors both within and beyond the utilities control, including humidity, temperature and winds. The legislation requires the utility to bear the burden to demonstrate, based upon a preponderance of the evidence, that its conduct was reasonable.

Wildfire Fund

Going forward AB 1054 creates the “Wildfire Fund” which would be used to pay eligible claims related to a covered wildfire. The fund will be jointly funded by utility shareholders and utility ratepayers. Utility shareholders will contribute \$7.5 billion initially and an additional \$3 billion over 10 years to the wildfire fund. On the other side, ratepayers will be assessed a non-bypassable energy usage charge of \$0.005 per kWh for 15 years. Combined, this equates to about \$13.5 billion, of which it is estimated that farming and food processing would contribute about \$1 billion of that over a

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Continued from Page 34

15 year period. Should the utilities be found imprudent in a wildfire event, they would have to repay monies to the fund. While this charge is new, ratepayers will not see a difference on their bills, because it will simply continue an already existing charge created during the energy crisis several years ago that was scheduled to end in 2020 or so. This new charge will not be assessed until the previous charge is completed.

PG&E Bankruptcy

Some have wondered how this affects the PG&E bankruptcy. AB 1054 requires PG&E to resolve all pre-bankruptcy claims and achieve a California Public Utilities Commission (CPUC) approved reorganization plan that is neutral to ratepayers. Therefore, PG&E shareholders would be responsible for all liability claims from the 2017 and 2018 wildfires, which is currently estimated to be close to \$30 billion! While AB 1054 doesn't solve all of our problems, it puts much of the onus back on the utilities and shareholders and limits, to some degree, the financial impact to ratepayers. Without it, ratepayers could have been looking at picking almost all of the cost. It's not perfect, but far better than it was looking.

Power Shutoff

It is also important to note what the legislation does not do. For one, it does not address the new calls for shutting down the grid in the events of potential emergencies. In PG&E's Public Safety Power Shutoff (PSPS) proposal, sections of the electric grid would be shutoff during periods of high winds, low humidity or high fire danger. Notices will be given in advance, but no guarantees on how long the power will be shutoff. Many farms, hullers and processors have already been notified they are in an area likely to be impacted by these shutoffs even though they are not in the actual area under threat of a fire. They are simply on the same grid.

It also does not address any of the other factors driving up electricity rates, such as greenhouse gas regulations on utilities, renewable energy supply requirements for utilities, or other rate cases the utilities have before the CPUC. All of these contribute to the highest electricity prices in the continental United States, and why all Californians should be concerned with electricity rates.

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FERTILIZATION:

Important Points to Consider When Fertilizing Hazelnuts



By DANITA CAHILL | Contributing Writer

TELLY WIRTH, OF TANGENT, IN Oregon's Willamette Valley, has this take on fertilizing hazelnuts: With each grower, each orchard, each season and each year, the needs will vary.

Moving to Hazelnut Production

The Wirth family's operation was originally a grass seed and grain farm, with some acreage planted in legumes and vegetable seed. With the bans on traditional field burning to kill pests, and disease spores, came the need for more chemical use—along with greater expense—to protect the grass seed. So, Telly began searching for a more profitable crop. About 10 years ago, hazelnuts entered the picture for the Wirth family.

Telly's family started farming in the early 1950s in the Crabtree, Oregon area. When his dad, Dennis was two years old, the Wirth family migrated 23 miles southwest to Shedd, where Dennis started out farming with his brother, Don. The brothers eventually separated their operations, passing down the management of their individual family farms. Telly now farms a total of 2,500 acres, mostly in the Shedd and Tangent area.

Telly majored in Crop and Soil Science at Oregon State University (OSU). In 1999, he graduated from college and married his college sweetheart, Amorita. Telly now grows approximately 140 acres of hazelnuts. He also grows hazelnut nursery stock in tie-off, or layering beds.

Fertilizer Program

As for Telly's hazelnut fertilizer

program, he starts out each year by taking soil samples in February. "Gives us an idea of what deficiencies to watch out for," he said. "Hazelnuts like a higher level of potash—some people call it potassium—and phosphorus in valley soils. South of Salem tends to have lower levels of those." Telly adds that there are pockets of different types of soil all over the valley.

In April to May, prior to active spring growth, Telly gives his non-bearing young hazelnut trees a starter fertilizer—a complete blend of nitrogen, phosphorus and potassium, plus some micronutrients, which he lays down in a 1-2-foot band. Also in May, his production trees get nitrogen and calcium, which he broadcasts on the entire orchard floor. In June or July, Telly gives one or two light feedings. In July, he starts pulling leaves for tissue samples. When the lab results are back on the

samples, he mixes up nutrients his trees need and gives them a foliar spray, along with a spray to control filbert worm.

In November, after harvest, the nitrogen leaches out, Telly said. He might then add phosphorus, potash, magnesium and zinc. "I'm looking to tailor something to get the soil in balance."

As far as nitrogen, some growers warn to use it sparingly or you will grow weak trees. Telly looks at new growth to tell him if his trees are getting enough nitrogen. He wants to see 12-18-inch whips each year.

When it comes to fertilizing hazelnuts, Telly believes in moderation. "I try to add a little every year, instead of dumping a whole bunch at once. It spreads cost out over time, too."

Growing Hazelnuts in Heavy Soil

Dennis Glaser, also of Tangent, was recognized by the Nut Growers Society



Telly Wirth checks on nut development on one of his hazelnut trees. All photos courtesy of Danita Cahill.



Telly Wirth measures the whip of a young hazelnut tree.



One of Mid-Valley Farm's hazelnut orchards under a bright, cloudy sky.



Hazelnut Research Agronomist Joe Cacka (center) talks to hazelnut growers about orchard nutrition during a tour of one of Mid-Valley Farm's orchards.

as the 2019 Hazelnut Grower of the Year. But in 1981, there were some folks who thought the ryegrass farmer was crazy for planting hazelnuts in the heavy soil, flatland area of the valley. Dennis didn't let other people's opinions stop him. He went on ahead and planted a Barcelona orchard that year, making him a pioneer in growing hazelnuts in the Mid-Willamette Valley.

"It all started because we were putting (drain) tile in the ground, looking for an alternative crop to grass seed. This is an alternative crop," Dennis said. Besides, he saw growers in the Newburg area having success with hazelnuts. He figured why not give it a try further south?

Trial and Error Fertilization

How did Dennis go about fertilizing his new valley-floor orchard? It was a brand new world—one of trial and error. No one quite knew how to feed these young hazelnut trees in heavy soil. "I remember my cousins in North Albany putting 100 pounds of Urea on. That's it," Dennis said.

Dennis and his son, Ryan, switched to drip irrigation five or six years ago. "Started with hand line," Dennis said. "It was a pain, but we did it for about 30 years."

Fertigation Program

Now that Glasers have made the switch, besides laying down bands of nutrients, they're also able to fertigate

through the drip system. They start irrigating in mid-July. As far as water and fertigation, Ryan said, "I'm on the trickle theory. I alternate sides of the tree, right or wrong. Theory being I don't want to concentrate all the roots on one side"

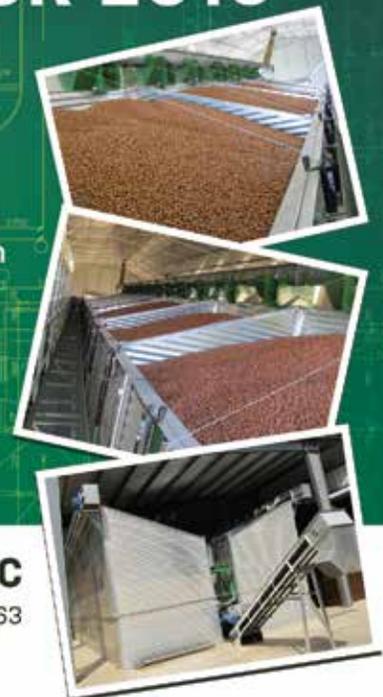
Ryan gives three shots—one each in June, July and August—of a 5-12-5 spray "kicker." His trees also get a shot of Levitate—which is the brand name

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of a low-salt starter fertilizer with phosphorus and zinc. Depending on tissue-test results, all of Ryan's trees—both nonbearing and those in production—will get a shot of Levitate. "It's good for structure growth and nuts as well," Ryan said. "I get pretty good growth throughout the season."

Sawdust or Compost

Sawdust or compost around trees is helpful in reserving moisture and giving a slow-release feed, but Ryan cautions growers to be careful with compost over the top of drip lines. "Roots can grow over the lines and create a real mess."

Ryan plans to hire a crop consultant and do pressure bomb tissue tests. A pressure bomb is a portable instrument. It uses pressurized gas to squeeze the moisture from a leaf out the stem. The amount of pressure needed is used to measure the water potential of plant tissue.

Nutrition and Fertigation Trials

Joe Cacka, Hazelnut Research Agronomist with Nutrien Ag Solutions Northwest Division said, "The first growers that put potassium chloride at high rates in the spring, instead of fall defoliated the trees. Took two years to grow out of it. They gave up on it."

Joe is currently conducting nutrition and fertigation trials in one of Glaser's' younger orchards. He's laid down a band

of fertilizer for three years in a row to get the potassium levels up in the trees. His trials show that 500 pounds of potassium chloride per acre produces a higher yield—400 more pounds of nuts per acre.

Growers have to figure out for themselves if the higher yields balance out the higher fertilizer costs, while still being careful not to get carried away with too much fertilizer. When Joe applied potassium chloride with an extra heavy hand—one ton per acre—the levels built up by about tenfold.

Soils will dry out by the end of June or mid-July, meaning that without irrigation, the least amount of nutrients are available during the nut-filling period, when the trees really need it.

Alternate Bearing and Nutrition

Hazelnut growers have historically seen alternate bearing years: One year of heavy nut production, followed by a year of lighter crop load. Joe posed the question: "How much does nutrition play a part in that?" Heat stress also affects crop production for the next year. Joe suggests taking a good look at nutrition needs in the fall, especially after a heavy crop. "If the tree isn't getting enough nutrients from the soil, it will pull it from the bark and roots. I think we can modify it (nutrition), so there isn't as big a drop from one year to the next."

A foliar application of calcium, magnesium, boron and zinc "equates to a 20-40 percent yield response in a given season," Joe said. "Nutrition plays a part in all aspects of growth, including if new nodes become new growth, or bearing branches. Nutrients going into new growth are different than nutrients going into nuts."

Joe sums it up by saying nutrition needs "really need to be customized to your operation." He urges growers to take tissue and soil samples and have them lab tested to find out exactly what their needs might be.

Joe also notes that although nutrients need to be pushed down to the tree-root zone, "You don't want to push down too deep, since eighty-five percent of roots are in the top two-feet of soil." He added that the sweet spot for nutrients is in the top 1-2 ½-foot zone.

Potassium

"It's really important to have good levels of potassium in trees," Joe said.

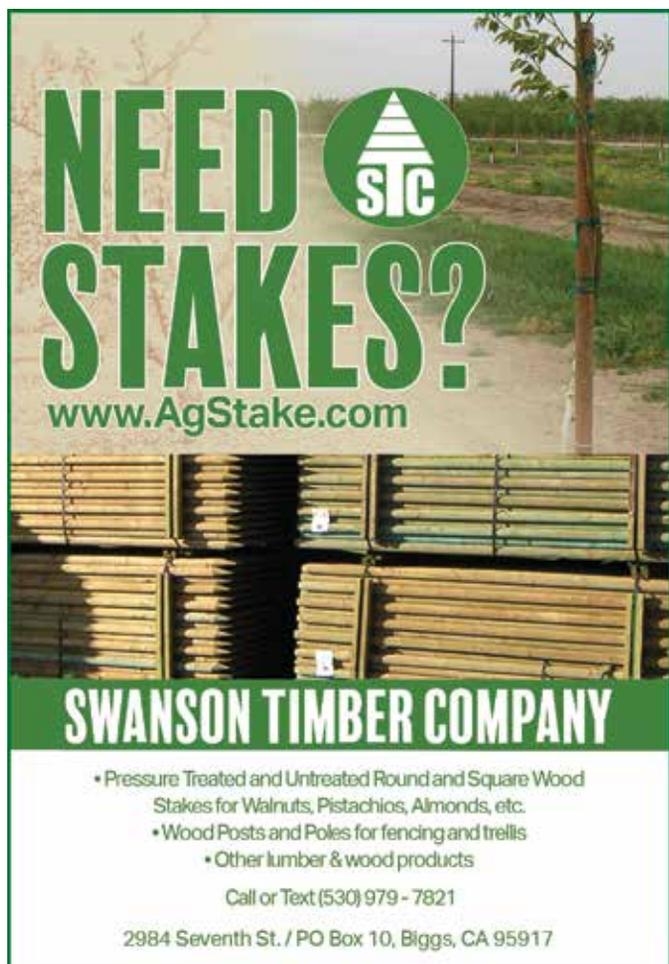
Potassium levels in leaves often don't increase until the year after application. Potassium deficient orchards tend to have early leaf fall, which creates more debris in the tote bins. To counter this, growers can use sulfate of potash or potassium chloride—the latter is cheaper.

"Apply potassium in the fall for the least cost. In spring it can damage," Joe reminds growers.

Joe suggests putting a fertilizer band down one side of the trees one year and switching sides the following year. Flail chopping pruned branches, leaves and husks back into the soil will create a slow-release fertilizer as the organic matter decays.

What does all this information tell hazelnut growers? In a nutshell, that there is always still more to learn.

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**Thursday
September 26**

1:00PM
Registration

2:00PM
Getting the Most out of Your Soil
Richard Kreps, CCA

2:30PM
How to Optimize IPM and Nutrient Management using Aerial Drone Technology
Mark Dufau, Director of Business Development for AeroVironment
CE Credits: 30 Minutes; Other

3:00PM
Managing Botrytis in a Challenging Year
Gabriel Torres, UCCE Farm Advisor, Tulare County
CE Credits: 30 Minutes; Other

3:30PM
The Latest in HLB and Asian Citrus Psyllid Management
Greg Douhan, UCCE Area Citrus Advisor for Tulare, Fresno, and Madera Counties
CE Credits: 30 Minutes; Other

4:00PM
Navigating Fungal Diseases
Themis Michailides, Professor and Plant Pathologist UC Davis
CE Credits: 30 Minutes; Other

4:30PM
Paraquat Closed Transfer System (New EPA Guidelines for 2020)
Charlene Bedal, West Coast Regional Manager, HELM AGRO US
CE Credits: 30 Minutes; L & R



5:00PM
Mixer/Trade Show
CE Credits: 30 Minutes; Other

6:00PM
Dinner

6:30PM
NOW Monitoring and Management – Current and Future Trends
Brent Short, Regional Technical Representative, Trécé, Inc.
CE Credits: 30 Minutes; Other



7:00PM
*Jason Bird
Magician and Illusionist*
Jason Bird will perform small group illusions during the trade show / mixer from 5-6PM

**Friday
September 27**

7:00AM
Breakfast / Going Above and Beyond for Your Grower – Keeping them Compliant
Patty Cardoso, Director of Grower Compliance for Gar Tootelian, Inc.

7:30AM
Trade Show
CE Credits: 30 Minutes; Other

8:00AM
Label Update
CE Credits: 50 Minutes; L & R
Plant Food Systems, Trécé, Helm, EarthSol, Suterra

8:50AM
Evaluation of Mating Disruption as Part of an IPM Program
Chuck Burks USDA

Dani Casado, Ph.D. in Applied Chemical Ecology, Suterra
Peter McGhee, Ph.D., Research Entomologist
Pacific Biocontrol Corp
CE Credits: 40 Minutes; Other

9:30AM
Update on the Sterile Insect Program for NOW
Houston Wilson, Asst. Coop. Extension Specialist, Kearney Ag. Center, Dept. Entomology, UC Riverside
CE Credits: 30 Minutes; Other

10:00AM
Trade Show Break
CE Credits: 30 Minutes; Other

11:00AM
Panel—Top Insects Plaguing California Specialty Crops—BMSB, Mealy Bugs/NOW Spotted Wing Drosophila
David Haviland (Mealy Bugs/NOW) UC Cooperative Extension, Kern County, Kent Daane (SWD) Cooperative Extension Specialist, UC Berkeley, Jhalendra Rijal (BMSB) UCCE IPM Advisor for northern San Joaquin Valley
CE Credits: 60 Minutes; Other

12:00PM
Lunch

12:15PM
A New Approach to IPM
Surendra Dara, Entomology and Biologicals Advisor, University of California Cooperative Extension
CE Credits: 30 Minutes; Other

1:00PM
Adjourn



PREPARING WALNUT TREES FOR WINTER

By KATHY COATNEY | Editor

FULLY DORMANT MATURE
Walnut trees can tolerate temperatures into the low 20's or below, so long as trees are in full dormancy, according to University of California Cooperative Extension (UCCE) farm advisor, emeritus, Wilbur Reil.

While it's tempting to push young tree growth as long as possible in the fall, it's also risky. Freezing temperatures can cause die back in young trees, sometimes almost to the roots. Freeze events can also severely damage trees in mid-winter if the soil is dry.

Fully dormant walnut trees can withstand temperatures well below freezing, but young trees are more susceptible to damage.

It can be particularly damaging for young trees when temperatures drop to 28 degrees F or below before they've experienced a few nights near 32 degrees F to become acclimated.

Trees can be managed for cold hardiness by:

- Stop nitrogen fertilizer applications after September first to avoid new growth.
- Stop irrigation in mid-September until terminal vegetative bud set.
- Once the terminal vegetative bud has set by mid- to late-October, another irrigation can take place if there has been no rain. On both mature and young trees this will moisten the soil and prevent premature defoliation without pushing new growth.
- Use protective white latex paint on the trunks.
- Delay pruning until March after the threat of frost is past.

Mature Trees

Luke Milliron, UCCE orchard systems advisor for Butte, Glenn and Tehama counties said, the concern for fall freeze damage has historically been young walnuts, but mature trees can be susceptible, too, under the right circumstances.

Previously young trees, in particular, were associated with autumn early freeze events, but in November 2018 young and mature trees were severely impacted with freeze damage in early November, Milliron said.

Whether mature or young trees, the advice remains the same, with increased caution for young trees, Milliron said.

"With young trees you don't want all this new tender growth that gets freeze damage, so you start that process of not heading into autumn with a bunch of brand new growth," Milliron said.

Water Management

Water management is a critical step to encouraging terminal bud set. Growers are advised to avoid irrigating in September until growth at the tips of the branches has stopped. Stop water until there is no new growth and red leaves, but not until the leaves yellow and defoliation occurs. Resume irrigation in October if there is no rainfall to ensure the soil is moist before a November freeze event.

"Withholding irrigation beginning in roughly mid-September until you see that a terminal vegetative bud has formed on the trunk," Milliron said, is the best protection.

Milliron reminds growers that once the terminal



New, vigorous growth on young trees is especially sensitive to frost injury. Photo courtesy of Janine Hasey.

vegetation bud is set water can be applied without resuming growth.

Higher Elevations

Rachel Elkins, UCCE pomology farm advisor and county director in Lake County, said, her growers typically get a certain amount of late fall or winter injury every year because they're at a higher elevation.

Continued on Page 46

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“We start our season later, and generally we can harvest into November,” Elkins said. “I’ve even seen us harvest into the very early part of December.”

When it comes to freeze injury, growers are used to it, Elkins said, but in 2018 freeze did come a little earlier.

Growers in Elkins area also had a great deal of rain this spring, so much rain in fact, sump pumps were running 24/7 because the water table was so high.

Elkins said, winter injuries are generally seen in weaker trees first, gravel areas, and southwest injury.

“For us I would say it’s a little bit more common (winter injury) than in other areas of the state,” Elkins said.

Elkins said, she thinks the very high water table that went into the spring also effected the trees in her area this year.

Elkins recommendations are similar to other farm advisors for young walnut trees. “I just always tell growers to make sure that they don’t irrigate them and fertilize them into the fall so that they keep growing because they’re very susceptible to severe winter injury,” she said, adding on mature trees it’s the same advice.

Latex Paint

Painting young trunks and shoots white can prevent freeze damage if applied prior to a freeze event. It can also minimize damage if applied as soon as possible after a freeze. Research by Bruce Lampinen UC walnut specialist showed painting after leaf fall with white interior latex paint diluted 50 percent with water minimizes damage to shoots and buds, especially on the southwest side of the tree. The paint helps moderate large temperature fluctuations between day and night after sunny winter days.

Painting freeze damaged section of the tree can also improve recovery and protect against winter sunburn on affected tissue. Determine freeze damage by looking for darkened cambial tissue below the bark that resembles sunburn. This is generally found on the south and west side of the tree on horizontal branches.

Elkins also advises painting the trunk almost below the



Withhold irrigation until a terminal vegetative bud sets on trunk. Photo courtesy of Janine Hasey.



After a severe freeze event cut into the southwest facing trunk, looking for dark brown discoloration of the cambium. Photo courtesy of Janine Hasey.

“If conditions continue to be dry and you still have leaves on the tree that means you’re still losing some water, so irrigating can be a good idea”

soil line. “That injury where the crown area meets soil line can be very susceptible, especially at planting,” she said.

Milliron advised, anytime there’s freeze damage to check the trunks and look for damage—specifically discoloration of the cambium layer.

“That’s going to be the main place where sunburn damage is going to occur,” Milliron said, adding for young and mature trees, but don’t paint the whole tree.

“We ran into some issues back in 2014-2015 where a lot of folks went out and they painted entire young trees,” Milliron said.

“We had a weird winter in terms of carbohydrates and budbreak where the buds just didn’t break where it was painted,” Milliron said, and that changed the whole energy balance of the tree. Instead, paint the southwest facing portion of the tree if damage is detected after a freeze event.

Painting damaged areas should be done as soon as possible after the freeze event.

Dry Soil Before a Freeze Event

“By mid to late October if there hasn’t been rain it’s a good idea to irrigate, so that you’re not heading into November with things being dry like they were this past year,” Milliron said.

Not only was there minimal rainfall last fall until the very end of November, there was also very low relative humidity, with wind that created dry conditions, Milliron said.

“If conditions continue to be dry and you still have leaves on the tree that means you’re still losing some water, so irrigating can be a good idea,” Milliron said.

In the past, the focus of November freeze events has





Before photo of a young orchard (second leaf) Chandler branch with distinct margin. Photo courtesy of Luke Milliron.



After of freeze damaged tissue. Photo courtesy of Luke Milliron.

been young trees until 2018 when the freeze damaged both young and mature trees, Milliron said.

For young and mature trees, Milliron said that if the ground is dry and there's a potential freeze event, irrigate.

Richard Snyder retired biometeorologist at UC Davis advises irrigating dry soil three to five days before the severe frost is predicted, Milliron said.

The goal is to rehydrate roughly the top foot of the profile to allow for more heat storage in the soil from the radiation during the day, Milliron said.

“You don’t want to be irrigating necessarily right before the freeze event because you don’t want saturated conditions or surface standing water,” Milliron said.

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WHAT YOU NEED TO KNOW ABOUT TRACE ELEMENTS FOR PECANS

By CECILIA PARSONS | Associate Editor

"Environmental stresses can cause developing nuts to drop from the tree, but premature shedding can also be due to lack of nutritional support of the embryo."

PECAN TREES MAY LOOK healthy, but still experience nutrient deficiency or toxicity when lacking in essential micronutrients.

Josh Sherman, University of Arizona Cooperative Extension horticultural advisor, in a presentation on essential micronutrients in pecan production, noted that 'hidden hunger' phase is where yields and profits are lost.

Micronutrients

Micronutrients are considered essential to plant health when the plant cannot

complete its life cycle if the element is deficient, when the element cannot be replaced by another element and when the element is directly involved in the nutrition of the plant.

Micronutrients, except for boron, are mostly trace metals. They are found in leaf tissue in much smaller amounts than macronutrients usually reported in parts per million (PPM). They are iron, copper, zinc, nickel, manganese and boron.

In pecan trees 'hidden hunger' occurs when a micronutrient is within the deficient level, but the tree is not showing

signs of deficiency, and it is not performing at optimal level.

Tree Nuts as Storage Units

Tree nuts, according to Ron Byford of New Mexico State University Plant Sciences department, serve as storage units on the tree. They store minerals as

Continued on Page 50

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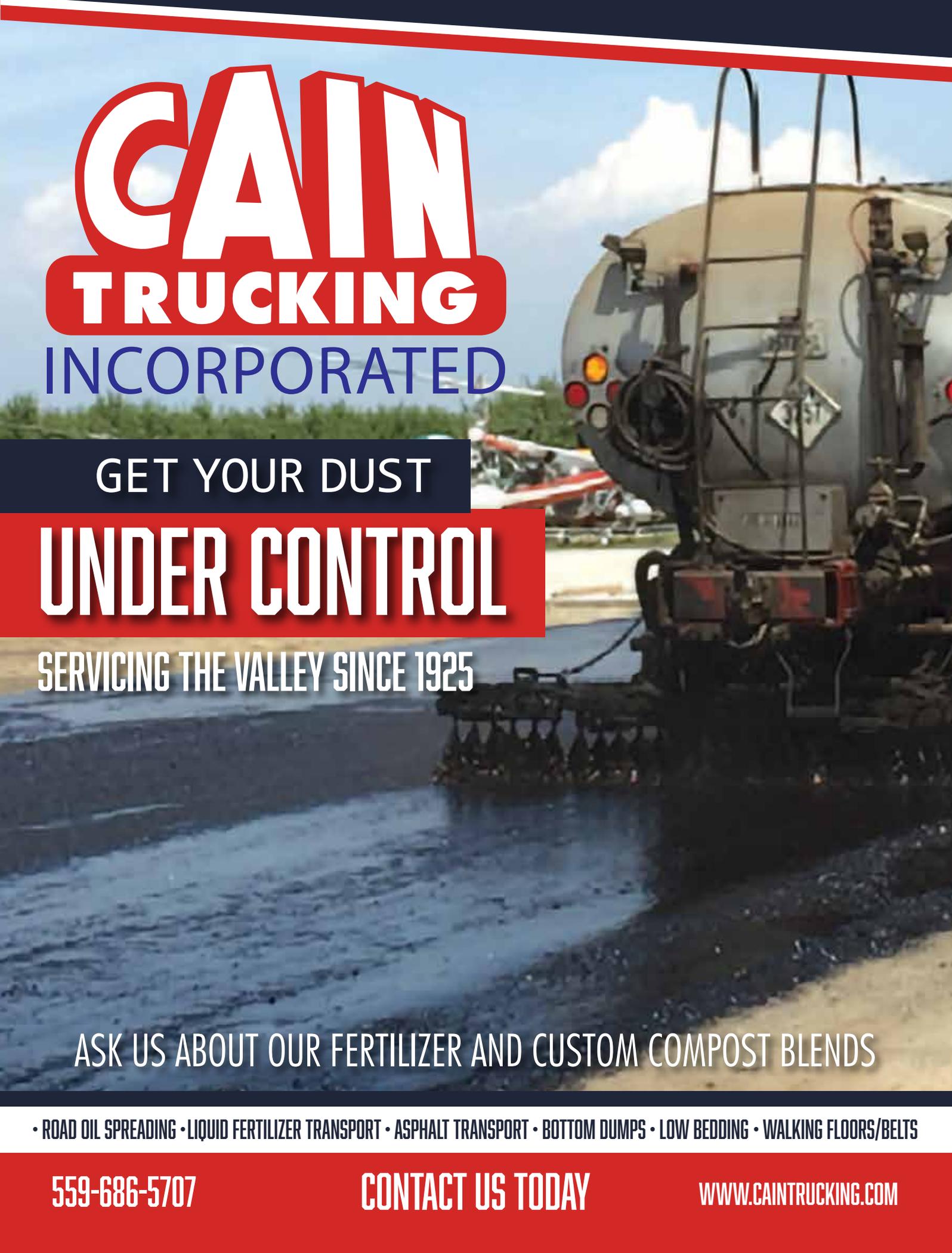
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well as the carbohydrates, oils, amino acids and proteins needed to sustain respiration, germination and to maintain the seedling until it has produced enough leaf area to be self sufficient.

Environmental stresses can cause developing nuts to drop from the tree, but premature shedding can also be due to lack of nutritional support of the embryo. Genetics play a part in eventual mature nut size, but nutritional status is also a factor.

During the last six weeks of nut fill, most of the storage materials are transferred to the nuts from nearby leaves and shoots. This movement can result in a serious drain on the tree's nutrient reserves.

With micronutrients in pecans, it is all about enzymes, carbon and timing.

Iron

This mineral functions as a component of electron transport in respiration. Excess manganese and copper can cause iron deficiency. Symptoms of iron deficiency include interveinal chlorosis of young leaves with sharp distinction between veins and interveinal areas. Overwatering trees worsens the problem.

Copper

Functions include electron transport of Photosystem I, enzymes in photosynthesis and detoxification of free radicals.

Visible symptoms of copper deficiency are rare, but include shoot dieback, interveinal chlorosis, bleached young leaves and dwarfed leaflets.

Excess nitrogen can cause copper deficiency, too.

Boron

Boron plays an important role in the movement of carbohydrates across cell walls and in the stability of the pollen germ tube. Inadequate boron levels can cause the germ tube to rupture, reducing fertilization. Leaf symptoms of boron deficiency are rare in the southwest. They are seen when leaf boron is less than 15 ppm. Normal growth is observed at 15-50 ppm.

Boron toxicity is a concern. Soil applied boron will generally remain for

one year as it can be rapidly leached by irrigation or rainfall. Calcium, potassium and zinc compete with boron for uptake. Monitoring leaf levels for all four is recommended.

Zinc

Zinc has a major influence on yields due to its effect on flowering, fruit size, leaf efficiency and nut yield. It is also important in leaf expansion and shoot elongation. Zinc must be available during those specific times. Even with adequate soil levels of zinc, availability depends on soil conditions. Deficiency symptoms include curling of young leaves, rosette patterns and shoot dieback. Sherman noted that new flushes of growth on pecan trees should receive a foliar application of this nutrient. Applications in the fall are ineffective. Zinc moves slowly in the soil and ground applications may take a year to be effective.

Manganese

This nutrient has a vital role in plant photosynthesis, capturing light energy and biosynthesis of chlorophyll. Manganese deficient trees will have pale color leaves and interveinal chlorosis along with necrosis of very young leaves. Toxic levels of manganese will cause delayed bud break and poor early development. Trees may defoliate then regrow large size leaves.

Nickel

This micronutrient is critical in nitrogen movement and enzyme reactions in plants. Its complete functions are not fully known. Nickel deficiencies disrupt primary and secondary metabolism, affecting early spring growth and natural defenses against pests and diseases. The most common sign of nickel deficiency is a growth abnormality in pecan trees called mouse-ear.

Sherman said in his presentation that one of the most important limiting factors for pecan trees growing in alkaline calcareous soils is the availability of the micronutrients. Though much research has been done on the function of micronutrients, their interactions are very complex and applications of one micronutrient will affect the availability of another.

Growers should send leaf samples annually in July-August to determine micronutrient concentrations for pecan production in their specific location. If foliar micronutrient applications have been done in the orchard, growers should request an acid wash of leaves prior to analysis.

Foliar and Soils

Soil interaction plays a role in the availability of micronutrients, Sherman said. As soil pH increases, micronutrient availability decreases. The alkaline and calcareous soils found in southwestern pecan growing regions can affect availability of iron, manganese, zinc and copper.

Certified crop advisor Richard Kreps said he finds that quicker adjustments can be made with foliar applications of micronutrients, but trees must be well hydrated prior to application. Kreps added that studies show some micronutrients like iron will see a 7:1 ratio of better uptake over soil applied nutrients. Much of that has to do with pH, soil texture, irrigation practices and water quality. In addition, with foliar applications, many growers never check their final tank pH when mixing sprays and just follow label instructions. Different water quality levels, pesticides, fungicides and adjuvants can drastically affect the final pH of a solution, further hindering nutrient uptake.

Kreps also stressed that soils play an important role in micronutrient uptake.

Soils with low cation exchange capacity, sandy soils, low organic matter and sterile soils will not hold the micronutrients as well especially if they are applied in big irrigation sets. The micronutrients applied in shorter pulse shots with time to absorb in the shallow feeder root zone. Soils with high carbonates, bicarbonates, calcium and phosphates especially in the poly form can tie up micronutrients as well. Glyphosate plays a key role in tying up manganese, so heavy weed pressure with respective herbicide applications can reduce that nutrient's availability significantly.

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Grower Profile: Vanella Farms

By JENNY HOLTERMANN | Contributing Writer



Ryan, Sue, Bob and Robert. All photos courtesy of Jenny Holtermann.

IN 1968, BOB VANELLA BOUGHT TEN ACRES IN Chico, California. His son, Ryan Vanella recalls the story of when Bob came to look at the property with a house and a huller in the back. He had always wanted a huller. After he

“By the mid-1990’s when the price of almonds came to \$.90 a pound, Bob and Sue made the decision to try marketing their own almonds.”

bought it, he went to tell his wife Sue, that he bought a huller with a little house in the front. She of course asked about the house. In which he replied “I don’t know, I didn’t look at the house. But there is a huller in the back”. Sue always knew Bob wanted to be a farmer, and from that 10 acres it all started.

Today, Bob and Sue farm with their two sons, Robert and Ryan. Robert mostly handling the walnut huller and harvesting while Ryan manages the almond huller and marketing. Together, they farm almonds, walnuts and diversified crops across the North State.

Vertically Integrated

Sue remembers they started farming by leasing orchards from a few neighbors and bought a shaker to be able to harvest as well. Bob’s father had an almond orchard down the street and the family wanted to be able to hull their own almonds. Over the years the family grew and their farm expanded. By the mid-1990’s when the price of almonds came to \$.90 a pound, Bob and Sue made the decision to try marketing their own almonds. Sue recalls “we weren’t doing a great job and kept getting a lot of bad advice”. Their goal was to do as much themselves so they didn’t have to rely on other people. Bob and Sue were committed to being vertically integrated and knew it was the best thing for their farm and their family.

In the meantime, Ryan worked off the farm after college at another local almond farm and learned how the processing side of almonds worked. In 2001, Ryan came back to the family farm and they started doing all their own almond processing. “Even today, we have never gone out and tried to get other business. The people we manage for or lease orchards from started sending us their product. As our other contracts were up, we just didn’t renew them and we started doing our own processing. We just started to all grow together. As farmers made more money, they started buying more property and we all grew our businesses together.”

“From that point we started to do everything ourselves. From planting an orchard, farming, management, harvesting, hulling, shelling, processing, exporting. That’s kind of been our business model.



Robert fixing hay rake.



Ryan checking equipment prior to harvest.



Almond bins line the entrance to the packing room.

We don't need to make all our money on just management or harvesting or hulling. If you can make a little bit on each step, everything ties together." Ryan agrees he would rather be busy and keep everything moving. Even Bob stays busy on the tractor every day. He is in his happy place planting a new orchard, he doesn't let his age stop him. "It's his job to drive us crazy," adds Ryan.

Processing

Processing has changed over the years as Ryan recalls the early days. "No electronic eye, no sorters. Just a couple ladies on a picking belt and hand held sewing machines tying bags together. Stacking everything on the containers by hand. It would take five guys about an hour and a half to hand stack 900 bags on the shipping containers. As we've grown, we learned we can do it with forklifts and machines. Trying to minimize hand labor and be more efficient."

Exports and Tarriffs

Today they are shipping almonds all over the country;

Continued on Page 54



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China, Vietnam, India, Turkey, Europe, Russia, and South America just to name a few. Ryan says he does very little domestic business. "It is cheaper to ship export product. It costs \$1,100-\$1,200 to ship my product from Chico to the port. But then to go from the port to China is only \$700. Our trucking costs are way more expensive than shipping costs. It is cheaper for me to ship across the world than across the country." Ryan also explains most of their almonds are inshell, making up about 75 percent of their exports. He is shipping to other manufacturers who are getting a final consumer grade product.

Last year, Ryan says they shipped more almonds to Vietnam than he ever had before. "It was just a very slow process and delaying the number of loads from Vietnam into China. What would normally take 45-60 days to go from Port of Oakland to China was taking 70-90 days." He is hopeful this

year that more almonds will continue to ship, he just wishes the tariffs would work themselves out quicker. "They have a lot of demand, but will China pay the tariffs or continue to bring it in from other countries? Will their price be able to sustain that cost? There is a huge demand, they need more almonds. We just need to get the tariffs figured out."

Ryan explains this isn't anything new. "Even in the last five years, at least 65 percent of what has shipped to China has gone through Vietnam." Shipping through brokers helps Ryan ship his product and cover some of the risk associated with shipping almonds and walnuts into difficult countries. The brokers can help alleviate when vendors don't want to pay if they have an issue with the product, especially when the market goes down. Ryan says "Vendors rarely complain when the market goes up, but always complain when the market goes down. To have a broker,

does cost a couple cents, but it helps manage risk in foreign countries."

If something happens to a container, he still has to pay the grower. Vanella Farms is selling product mostly for growers who they at least do their hulling. He lets the growers decide how they want to get paid. They can sell it all before January or he will watch the market and sell throughout the year if that is what the grower wants. They can pick when they need the cash flow. Ryan says it is a good model they seem to like and still have control over their crop.

Ryan tries to pack and sell product all twelve months throughout the year. "I want to get the highs, get the lows and I also get the average. That is all I can ask. If I know the market looks good, I might sell more that month. But I want to be able to sell product every month

Continued on Page 56

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Vanella's almonds awaiting harvest.

Continued from Page 54

and get a more stable average for pricing.” By August 1st, Ryan tries to have everything sold and shipped. They do want walnuts to sell sooner, and not keep them during the hot summer months.

Walnuts

The Vanella's more recently started shipping walnuts just ten years ago. They expanded with a walnut huller and

dryer in 2010, when their buyers realized they also farm walnuts. The customers were asking for them, so they started with a couple loads and went from there. They did about twenty loads one year, then fifty loads, the following year 100 loads and this year they will probably be about 200 loads.

Ryan explains, “There were a lot of walnuts planted when the price hit \$2 a pound. There aren't enough facilities that can hull and dry the new crop coming off. We put in a new walnut huller just three years ago with the capacity to double it, and we already need to expand it. We just keep putting in more dryer bins every year.” Even with the walnut price being very low recently, farmers still need a place to dry their crop. Farmers aren't ripping out their young orchards and in fact they are still planting walnuts. In a few years, there is going to be a lot more volume of walnuts coming and the Vanella's hope to be able to expand with the new production.

Marketing Walnuts

While the demand for walnuts is there worldwide, the marketing still needs to catch up. Sue points out that almonds have an advantage in the Middle Eastern countries “almonds are more ceremonial, and are a high-status nut. Walnuts are sold for more health reasons to them.” Walnuts being grown in more countries, puts California growers in less of an advantage.

Ryan points out, last year when the California walnut crop was down the price was still low. “You don't get that in almonds, when the crop is down the price is higher because they are at more of a demand. In walnuts, when the crop is down 15 percent and the price is down 20 percent that hurts all of us.” But Ryan is optimistic that walnuts will come back up in price, maybe not \$2 a pound, but hopefully closer to \$1 a pound.

Number One Concern—Safety

With so many factors and functions involved in getting an end product, the number one concern for Vanella Farms is safety. With all the employees required to run

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a successful family farm from the orchard to the export container, they are constantly ensuring a safe work environment for their employees. Ryan

states, “As we grow, we have more employees and now scattered over three counties. Even with monthly safety meetings, regular tailgate meetings, its still the first thing on my mind to keep everyone safe.”

With more regulations and agencies having to report to, they have also had to add more employees to keep up with the paperwork. “We have always handled that through our management services, but now we are having to hire more people to handle this level of paperwork that has nothing to do with farming. Walnuts are only making \$.75-80 a pound and we are having to add these layers of paperwork and more employees to help with it. These employees aren’t adding more income. Ideally, we need the price up to help pay for it, but the buyers do not care if you have more regulations.”

Next Generation

The Vanella’s also have the next generation working on the farm now. Their next generation is starting as teenagers

working in the summer. In the next ten years, they very well could be back on the farm in a manager type role. Ryan says, “With or without the next generation, we have grown a lot over the past few years and we haven’t grown a lot in management roles. There is a lot of stages in our operation from orchards, management, hulling, packing, times two for almonds and walnuts. We will need more skilled managers.” Vanella Farms could look very different in the years to come, with more younger generations having more responsibilities and roles on the family business.

Sue adds, “This has been a great way to raise a family. It is really neat as a grandma, to be able to see all my grandkids growing up together, being friends and possibly working together in the future. That’s what we do it for.”

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Nitrogen in Walnuts— What, When, Where and How Much?

By JULIE R. JOHNSON | Contributing Writer

TO KNOW HOW TO CORRECTLY use nitrogen in walnut orchards, you first have to know some of the basic principles of nitrogen, according to Katherine Jarvis-Shean, University of California Cooperative Extension area orchard systems adviser for Sacramento, Solano, and Yolo counties. Jarvis-Shean shared this information during the Nickels Soil Lab Annual Field Day in her presentation—Nitrogen in Walnuts: What, When, Where and How Much?

Nitrogen Principles

Jarvis-Shean said growers have a few different forms of nitrogen as options of use in their agriculture systems.

“Nitrogen is one part of soil organic matter, one part of urea, as in ammonium, and then nitrate,” she explained. “So those are ways we encounter nitrogen in our soils when we are trying to get it up into our plants.”

Unless a grower is in an organic system, soil organic matter is not a huge source of nitrogen for most ag systems. In those circumstances, the nitrogen input sources from soil organic matter must come through nitrogen-based cover crops or manure compost.

“It is like a savings account from which

you get a small dividend every month, it is a slow leak out of nitrogen from soil organic matter, but it is never a big wallop,” Jarvis-Shean said.

Urea is a neutral that moves through the soil with water, she added. Urea doesn't stick in the soil profile, but it does change to ammonium in a matter of days after it has been applied because of micro activity in the soil.

“Think of urea as acting like ammonium, as it changes to ammonium pretty quickly,” Jarvis-Shean said. “This leaves us with ammonium and nitrate, our two big hitters in our nitrogen system.”

She explained that ammonium is positively charged, and while this doesn't seem to be a big deal, it is.

“Because the surface of the soil is negatively charged, so ammonium will stick in the soil, which we like, as that means it doesn't leach out of the soil system and the roots can take up nitrogen in the form of ammonium,” she stated.

Nitrate, on the other hand, is negatively charged, which means it wants to stay away from the negatively charged soil, so it doesn't want to stick.

“This keeps it moving through the soil system when water is applied,” Jarvis-Shean said. “Nitrate leaches out very

easily through the root zone when putting water on top of it, and moving it through the soil and root zone.”

Nitrate is easily taken up by the roots so we like that part of it, she added, but it has this liability of being leachable.

“So you might say, let's just get around all these leaching problems by just applying ammonium—unfortunately it is not that easy, because ammonium will be munched on by microbes and turn into nitrate—we call it nitrification,” Jarvis-Shean advised. “And that, in California's soil systems, happens pretty quickly. So with the temperatures we have in the growing season, about half the ammonium applied will turn into nitrate in about two weeks if it hasn't been taken up by the tree.

That's a pretty quick turn around, so we can't put a lot of nitrogen on in the form of ammonium in the beginning of the growing season and hope it will get us through the whole growing season because a lot of that can turn into nitrate and leach out of the root zone.”

The Four R's of Nitrogen Management

With the basic principals of nitrogen in hand, Jarvis-Shean talked about the four R's of nitrogen management in walnuts—What, When, Where and How Much or otherwise known as “the right time, the right place, the right rate, and the right source.”

She said:

- Right rate is about matching the overall seasonal demand with your overall season's nitrogen application.
- Right time is keeping in mind that



Katherine Jarvis-Shean, UCCE area orchard systems adviser for Sacramento, Solano, and Yolo counties, gives her presentation—Nitrogen in Walnuts: What, When, Where and How Much?, to a group during this year's Nickels Soil Lab Annual Field Day. All photos courtesy of Julie R. Johnson.

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trees, plants in general, are best at taking up nitrogen when they need it. It uses some energy for the plant to take up nitrogen so they aren't going to do it unless they have a use for it. The right time is getting the nitrogen on when the tree demands it.

- Right place is remembering its the roots that take up nitrogen, so thinking about where those roots are is key, and keeping the nitrogen in the root zone.
- Right source is a little less straight forward. There is no one perfect answer for the whole Sacramento Valley, but there are different options.

Right Rate

How much nitrogen is in every ton of nuts?—is another way of asking the question of right rate, Jarvis-Shean shared.

Growers need to think about matching supply, what they are putting in, with the demand—this is on a mature tree that isn't growing any more but mostly just growing and harvesting nuts.

How do you figure this out, what is the demand?

Jarvis-Shean referred to research conducted in "a big three year project, where we were in two variety of orchards, Tulare and Chandler in Hanford, Linden and in Red Bluff, so we were covering the whole valley with different growing conditions and different growers. The team sampled at the end of the growing season how much nitrogen was in the walnuts in the test orchards."

The research team found on average 29 pounds of nitrogen for every ton of in-shell nuts, she said.

Right now the nitrogen number for irrigated lands per every ton of nuts is about 35 pounds or less, according to Jarvis-Shean.

"Everyone has been tightening their nitrogen belt already, and it's going to get a little tighter as we believe that number is going to be less in the end," she added. "We haven't published this number yet because we are triple checking the numbers to make sure they are right before we suggest you put on even less nitrogen, but we are pretty sure our numbers are true."

So, in summary, Jarvis-Shean said, a minimum of 29 pounds nitrogen for

in-shell nuts, is what you need to meet the demand of growing a crop. Taking into account not just the synthetic nitrogen added, but also nitrogen in the water and anything from cover crops and manures.

Right Time

The right timing is critical in supplying nitrogen when trees need it the most. It also decreases risk of nitrate leaching below the root zone and into the environment.

Growers have traditionally made two applications of nitrogen in May and July. However, Jarvis-Shean said, during their three year study, researchers went out to the test orchards every month to check how much nitrogen is in the walnut this month, compared to how much was in the walnut the previous month and found an even application over a four month period to be more productive.

Supplying nitrogen to trees needs to take place in May, June, July, and August as those are the months researchers found the trees have the greatest demand, she added.

"We found a pretty even demand through those months," Jarvis-Shean said. "The takeaway here is the right rate of nitrogen applied evenly over those months."

Researchers found in April, nitrogen in the walnut tree comes from storage in the trunk and in the roots. "So, if you are putting nitrogen on in April, it is not going to be taken up, it is going to just sit there, vulnerable to leaching from rain water and irrigation," she added.

Right Place

A grower can get walnut roots down to 10 feet, however, Jarvis-Shean said, the vast majority of roots will be in the top three feet of the root zone.

"So, researchers overall found a lot of roots in the top two feet, some in the top three feet and then it starts to peter-out," she explained. "When we decide where we want our nitrogen to be, it is in these top three feet of the soil, which, practically speaking is the root zone."

The right place is as much an irrigation question, as it is a fertilizer management question, because growers want to be irrigating in such a manner as to keep the water in the top three feet, according



Katherine Jarvis-Shean, UCCE orchard systems advisor, says the right source of nitrogen for orchard application can be different for each grower, but reminds that the potential for leaching is always something to consider.

try to keep in mind, she said, irrigating past three feet is pushing nitrogen past three feet and it is wasted.

Right Source

Javis-Shean said the right source is the trickiest one of the four R's.

“There is no one right answer to this question for every orchard across the board,” she added. “Just remember, different fertilizer sources, such as ammonium nitrate, ammonium sulfate, calcium ammonium nitrate, calcium nitrate, urea, and urea ammonium nitrate—some have nitrate, some have ammonium, some have urea.”

Ammonium and urea are not as vulnerable to leaching, while nitrate has high leaching potential.

“You might choose a fertilizer for a lot of different reasons,” Jarvis-Shean said, “maybe you’re trying to certify your soil at the same time. Maybe you need a source of calcium, but keep in mind each of these sources come with their own leaching story, their own leaching baggage.”

If applying a calcium nitrate, she

explained, that is all nitrate which is highly susceptible to leaching, so keep that in mind and divide it as much as possible over the course of the growing season and really focus on keeping the water in the top three feet of the root zone.

As for ammonium sulfate application, there is no nitrate in that, so growers have a little more wiggle room in water management and it can be applied four times a year instead of six to eight.

Summary

Jarvis-Shean summed up her information with the reminders of a minimum of 29 pounds of nitrogen per ton of walnuts, applied evenly over the course of the growing season in the top three feet of the soil, and there is no one right source of nitrogen application for all growers, but think about the leaching potential of any source of fertilizer used.

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to Jarvis-Shean.

Whether that is accomplished by looking at evapotranspiration (ET) scheduling, looking at emails provided by farm advisors are sharing now that show a generic walnut water use in any given week, or use soil moisture probes telling when the water has hit three feet—there are many ways to approach this goal, but



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MORE EFFICIENCY WITH LESS LABOR: THE COMING AGE OF AUTONOMOUS EQUIPMENT

By BRIAN GERMAN | Contributing Writer



Autonomous sprayer making a spray application in an almond orchard. All photos courtesy of Gary Thompson, GUSS Automation, LLC.

THE AGRICULTURE INDUSTRY has been steadily adopting more and more digital advancements that have been made available since the coming of the new millennium. The implementation of technological

breakthroughs appears to be coming at a more rapid pace as connectivity improvements and software innovations increasingly develop. One particular area of technological advancement that is projected to grow significantly in

the coming years is the development and demand for autonomous farming equipment.

Autonomous farm equipment can include tractors, harvesters, thinners, sprayers, as well as any other equipment that does not require a human operator to be onboard the machine to operate it. Using autonomous equipment can assist growers in a multitude of areas. For California farmers in particular, the necessity of maximizing the efficiency of an orchard in every possible area is highlighted by the consistently increasing number of regulations combined with the steadily declining amount of available labor.

“We talk to so many growers that say, ‘I’ve got this equipment, that’s not the problem. I can’t find the people; therefore, I’m not getting the sprays on my trees that I need to get on. So, if I can just get the sprays on my trees, that’s going to be huge for the return to me, that my crop will give me,’” said Gary Thompson, Marketing Director for GUSS Automation, LLC.

GUSS is an acronym for ‘Global Unmanned Spray System.’ The GUSS rig is an autonomous-driving agricultural sprayer invented by Dave Crinklaw, initially as a means of improving the efficiency of his own commercial spraying business. The lack of available labor to operate tractors necessitated the creation of a driverless

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Autonomous sprayer making a spray application in an almond orchard.



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system. Understanding the labor challenge in California was not likely to improve, the logical move was to start working on a manufacturing facility to make the GUSS available for purchase to other growers looking to address

operational needs.

The 2019 labor survey conducted by the California Farm Bureau Federation and the University of California, Davis, found that 56 percent of farmers who participated

indicated an inability to find enough labor at some point over the past five years. Nearly a full 20 percent of all the farmers who participated in the

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survey identified themselves as tree nut growers. Implementing autonomous equipment whenever possible can reduce the amount of labor necessary, as well as substantially lessen the amount of time required to complete certain tasks.

Less Time in an Orchard Means Less Money Spent

While individual orchards and materials can vary, Thompson noted that in general each GUSS rig can complete six acres an hour. A single worker can monitor a total of eight GUSS units that are simultaneously operating in an orchard. “It’s a very efficient way of spraying as compared to having employees on the tractors. You have a lot less stopped and down time,” said Thompson.

Regulatory changes to how often and what times agricultural workers can

be deployed in an orchard can also be addressed through autonomous equipment. Materials that have a limited window of time that an application can be made can sometimes be at odds with labor availability and compensation rates. Deploying autonomous equipment can assist with a timely application, particularly when dealing with a large amount of acreage.

“There’s just really no reason for the machine to stop with the exception of getting its material refilled and getting diesel put in it,” said Thompson. “These things run day and night—there’s 24-hour a day operation—you can just go, go and go.”

Deploying an autonomous piece of farming equipment can help to overcome the issue of labor availability and reduce the time required to complete certain tasks. Equipment such as a GUSS rig can replace a group

of tractor operators with a single person to oversee a group of tractors. Lowering the number of workers that are necessary can also reduce the number of mistakes and inaccuracies in many cases.

Fewer Workers, Less Opportunity for Error

Driverless tractors and other autonomous agricultural equipment not only help reduce the amount of labor that is required on a farming operation, but also improve the accuracy and efficiency of record keeping. As more and more regulations are implemented that require detailed records of material applications and other farming necessities, digitalized equipment will increase in value to a grower.

“GUSS spray rigs record everything that they do. So, the application rate, the flow, everything. Where they are, what

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time it is, what day, which ranch. We even type in what we're spraying—what type of tree—what material we're spraying," said Thompson. "At the end of our application all of this is downloaded to a thumb drive and can be handed to a grower."

Reducing the number of workers also significantly lowers the potential for work-related accidents, as well as costly operator errors. A digitized system that employs machine learning through various sensors which monitor actions in real-time can be immensely more effective than traditional labor. The task performed by an autonomous machine can greatly increase efficiency, replacing the potential of operator error with precise diagnostic capabilities that ensure work is performed correctly.

"[The operator] clicks on any individual rig and it tells him all the pertinent information from that spray rig," said Thompson. "If there's a drop or a rise outside of a certain parameter that we set, it'll alert him to an individual machine that he's got to check out and see what the problem is."

The GUSS rigs are only one example of how autonomous farming equipment can improve efficiency on a farming operation. There is a plethora of driverless equipment already available to farmers and development is projected to expand rapidly over the coming years as awareness and demand increases.

The Future Appears More Autonomous Than Ever

The idea for autonomous farming equipment has always been there but remained solely as a concept, for the technology required had not yet reached the point of viability of development. The expansive implementation of the 'internet of things' combined with advancements made in robotics technology, has only been made available on a large scale in roughly the past decade. Increasing demand for autonomous farming equipment, fueled by pressure for higher production efficiency, will continue to spur even more

development of the technology going forward.

According to market research from Global Market Insights, Inc., the market value for autonomous farm equipment is expected to more than triple by 2024, reaching a value of more than \$180 billion. The size of the autonomous farm equipment industry was valued at just \$55 billion in 2016, with expansive growth expected by the majority of industry experts.

A similar report titled "Autonomous Farm Equipment Market-Growth, Future Prospects and Competitive Landscape, 2017-2025," published by Credence Research, indicates that tractors accounted for the largest share of the overall global market for autonomous equipment in 2016. Over the next few years autonomous harvesters are

projected to overtake tractors in terms of market share, as increasing development and demand is set to drive the sector forward.

The more interest there is in autonomous equipment, the more rapidly development in the area will continue. Equipment will also start to become more affordable as with other technological breakthroughs that eventually move into the mainstream. As labor costs and regulation continue to put increasing pressure on the agricultural industry, the notion of deploying a fleet of autonomous thinners, sprayers and harvesters may become a reality sooner than anticipated.

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DIXON RIDGE FARMS:

A Case Study in Sustainability

By THE CALIFORNIA WALNUT BOARD | Contributing Writer

SynTech Bioenergy "BioMax®" units at Dixon Ridge Farms. BioMax® 100 Gen1 (L), BioMax® Gen2 (R)

SUSTAINABILITY SEEMS TO be the new buzzword lately. From farms to retailers, and across many industries, everyone is talking about sustainability. But for some, like Winters-based Dixon Ridge Farms, a vertically integrated organic walnut grower, huller-dehydrator and processor, it has long been a way of doing business. Before sustainability became 'cool', Russ Lester, owner of Dixon Ridge Farms, was employing the whole systems approach to growing, harvesting and packing organic walnuts. This meant working with nature and being precise and selective with resource inputs; for example, allowing beneficial insect predators to thrive rather than use harsher chemicals, no or low tillage, cover cropping to maintain soil fertility and health, reducing water use through precise irrigation, using efficient equipment to minimize energy loss, using solar panels and reusing heat to further maximize drying efficiencies, using recycled paper for packaging material,

“
In 2007, Dixon Ridge Farms took things to the next level by installing an on-farm energy generator that used walnut shells.
”

and so on. It is a classic example of following the 3 R's—Reduce, Reuse and Recycle, which makes both environmental and economic sense.

Next Level Farming

In 2007, Dixon Ridge Farms took things to the next level by installing an on-farm energy generator that used walnut shells. The BioMax® 50, a 50 kilowatt biomass energy generator was the first of its kind in the entire state. Prior to that, most of the walnut shells were sent to regional biomass energy plants. But such 'cogen' power plants had their own issues of emissions and air quality. Moreover, such biomass

energy plants have been steadily losing ground to tax subsidized solar energy plants or cheap natural gas plants, creating a headache for farmers regarding farm waste disposal. Dixon Ridge Farms' partner in this venture was Community Power Company (CPC), a wholly owned subsidiary of SynTech Bioenergy LLC, which specializes in modular on-farm bioenergy generator units that use various agricultural waste feedstock to produce energy and heat. This at once achieved multiple objectives—reusing agricultural waste that would otherwise go to landfills, generating clean, carbon negative energy for on farm use, reducing or eliminating

the need for fossil fuel based energy and the associated costs of procuring it, and above all, greatly reducing the environmental impact of the operation. This project resulted in Dixon Ridge Farms being honored with the prestigious Governor's Environmental and Economic Leadership Award (GEELA).

Second Unit

In 2012, Dixon Ridge Farms upgraded to the BioMax® 100 Gen1 unit. All in all, it produces 643,000 kWh, enough to provide some \$102,000 worth of electricity and off set \$24,000 worth of propane used for drying walnuts. This was followed by the installation of a second unit, the BioMax® Gen2, in 2014 (see photo 1). Further, biochar, a byproduct of the energy generation, can be incorporated into soil as a nutrient and moisture retention and release media. The biochar effectively binds fertilizers and irrigation water and releases them slowly and evenly rather than all at once, thereby preventing loss of nutrients and water. This, in turn, would help avoid air and water quality issues caused by aerosolization (Nitrous oxide) and leaching (Nitrate). Biochar also provides food and shelter to beneficial organisms residing in the soil, thereby boosting soil health.

Regulatory Changes

Russ invited UC Davis researchers to look at his operations, and they found that Dixon Ridge Farms was, in fact, carbon negative, i.e. it was removing more carbon dioxide than adding to it. While most businesses are still striving to be carbon neutral, Dixon Ridge Farms was ahead of the curve. This partnership with SynTech has brought a second GEELA award for Dixon Ridge Farms in 2018. In addition, Russ has received numerous other awards such as EPA Sustainable Agriculture Champion Award (2012) and IPM Innovator Award (2011) among others. But he is far from being done. He wants to continue fine tuning his operation so they can utilize all byproducts generated on the farm. He also wants to continue advocating for regulatory

changes so renewable sources like agricultural byproduct get the same respect and level playing field as solar and wind does. He would like to see more common sense regulations governing on-farm renewable energy generation so farms like his willing to invest in bioenergy projects are not hamstrung by policies and politics involving utility companies. But above all, he would like everyone to remember one very important thing....it is farmers who feed the society.

(Sources: Dixon Ridge Farms: <http://www.dixonridgefarms.com/home.html>; SynTech Bioenergy LLC: <https://www.syntechbioenergy.com/>)



Russ Lester (R) and Wayne McFarland (L) in front of the BioMax® Gen2 unit at Dixon Ridge Farms

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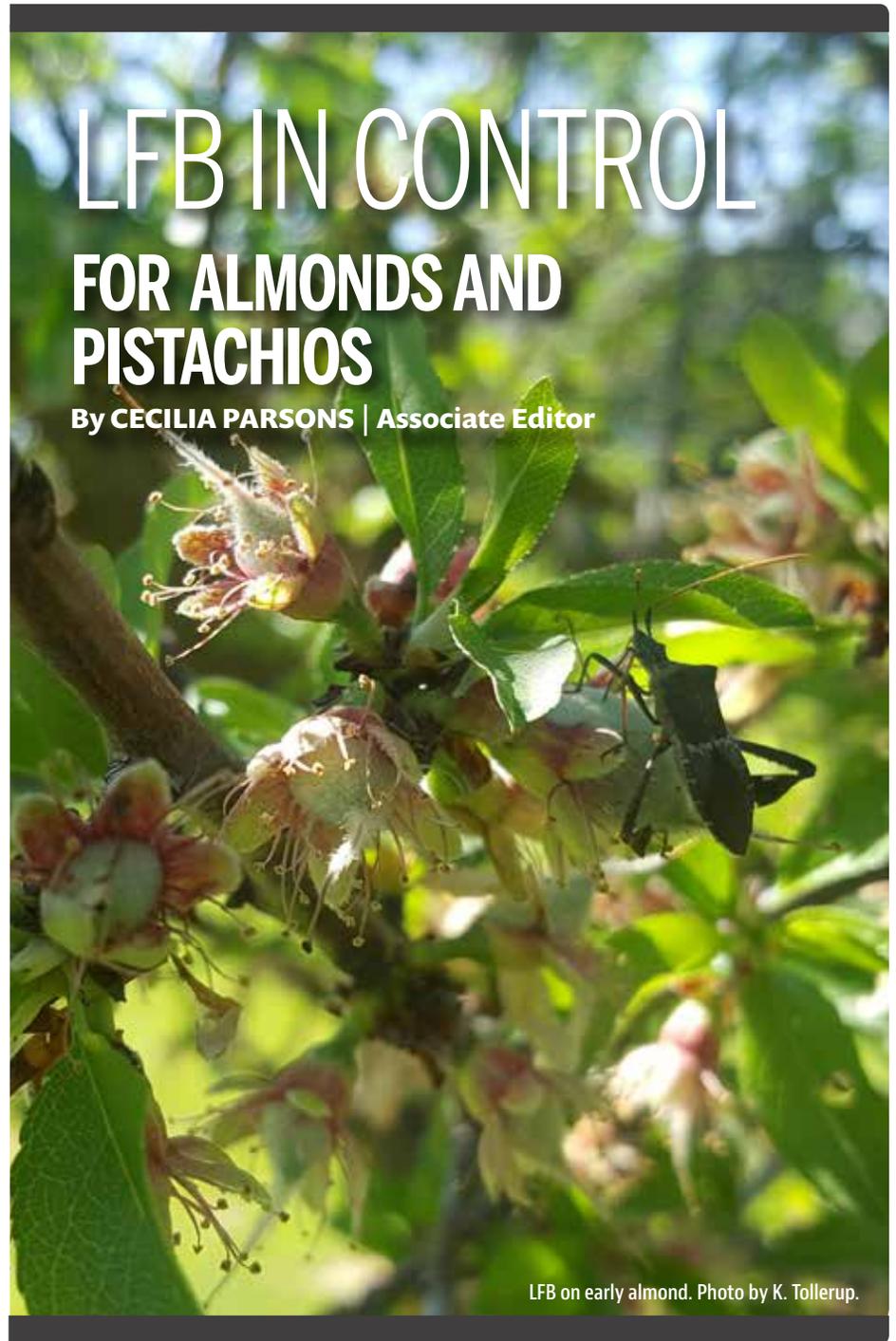
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LFB IN CONTROL FOR ALMONDS AND PISTACHIOS

By CECILIA PARSONS | Associate Editor

LFB on early almond. Photo by K. Tollerup.

WHEN YOU SEE ADULT leaf-footed bugs (LFB) in your almond or pistachio orchards, it is time to take action.

There is no established threshold for economic damage caused by this piercing-sucking pest, said Kris Tollerup, UC Cooperative Extension area Integrated Pest Management advisor. Traps and lures for LFB are still being evaluated. Visual observation of LFB in an orchard should prompt treatment, advisors said.

LFB

This large insect pest is a native of California, and has been found in the San Joaquin Valley from Butte to Kern counties. While LFB may be found in most valley locations, there are specific environmental conditions that allow for populations to build. Those conditions include riparian areas, protected overwintering sites and host plants. Almond and pistachio orchards adjacent to those sites can become infested and

are vulnerable to crop loss or damage from LFB.

Tollerup said he has seen a 50 percent almond crop loss in an orchard where LFB feeding early in the growing season caused nuts to drop from the trees.

Leaffooted bug species include *Leptoglossus zonatus*, *L. clypealis* and *L. occidentalis*. Their name comes from the small, leaf-like projections on their hind legs. Adults in all three are about 0.75 to 1 inch long and have narrow brown bodies with a white zigzag pattern across the wings. *Zonatus*, which has become the dominant LFB specie in the San Joaquin Valley, can be identified by two yellow spots just behind the head.

Overwintering

Leaffooted bugs' overwintering capability can lead to high populations in the spring. This insect pest can tolerate temperatures down to 21 degrees F for six hours, Tollerup said. Milder winter weather and this species' ability to find shelter are factors in higher infestation rates in orchards. This pest is commonly associated with pomegranates that provide a feeding/reproduction site after nut harvest. But, it is also finds shelter in ornamental perennial plants including palm and cypress trees. These pests also seek shelter in eucalyptus trees and outbuildings.

Almond and pistachio orchards adjacent to riparian sites and other prime overwintering sites are more likely to suffer LFB feeding damage, Tollerup said.

Last year, Tollerup said he was in a fifth-leaf almond orchard adjacent to a somewhat neglected pomegranate planting. The orchard lost half its crop due to a large population of LFB feeding on the nuts early in the season.

Overwintering sites that provide adequate shelter are springboards for the next generation of LFB to hatch in the spring. Adult LFB that survive winter can lay more than 200 eggs in string like strands on host plants. Nymphs emerge from the eggs about one week later and develop into adults in 5-8 weeks. Adults can lay eggs over an extended period, creating a population that includes all life stages by late June. During the

spring and summer there are typically two to three generations of LFB. In the fall, all LFB develop until they become adults. These will overwinter in aggregations.

Adult leaffooted bugs' mouthparts can pierce developing nuts to suck out juice. These mouthparts comprise more than half their length and allow them to probe deep into fruit in search seeds. Nymphs have less of an impact when feeding, generally only extracting

plant juices. According to UC IPM Guidelines, LFB excretes digestive enzymes when feeding to liquefy a small part of the seed so that it can be ingested. Tollerup hypothesized that the enzyme also stains the pellicle of almond kernels.

Management of LFB

Tollerup said almond growers and

Continued on Page 70

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pest control advisors should begin scouting for adult LFB in March. If LFB are present in the orchard, they are more likely to be found on the sunny side of the tree. No lures or attractants are available to monitor for LFB presence, Tollerup said, but observing adults, and finding signs of feeding on nuts would indicate a need for control.

Pistachio growers and pest control advisors should look for adult LFB in

April and May when they move into orchards to feed and lay eggs. There is no economic threshold for LFB in pistachio, Tollerup said. If adults are observed in the trees, growers or managers will have to decide if the numbers warrant a pesticide application.

The most effective control materials for LFB are pyrethroids due to their residual activity. Tollerup said these

products, if applied correctly, could provide control. Other management strategies include removal of host plants if possible. Removal of weedy areas that serve as a food source during winter months can also help keep LFB numbers down.

Both pest control advisor Justin Nay and University of California Cooperative Extension (UCCE) specialist Houston Wilson agreed that almond and pistachio blocks with a history of LFB infestations are most likely to have recurring infestations. This year appears to be a light year for LFB, Nay said. Infestations that were found were in the blocks in areas that get them almost every year. Total amount of nuts lost for his growers was very small, with the worst blocks losing less than one percent.

In April a few of the almond blocks Nay watches had enough LFB to justify a treatment, but the total was only a small fraction of blocks under his supervision. Blocks were in both the north and south and in areas that get LFB every year.

Nay's pistachio blocks were just starting to meat fill in early July, and it was too early for LFB to move into that crop.

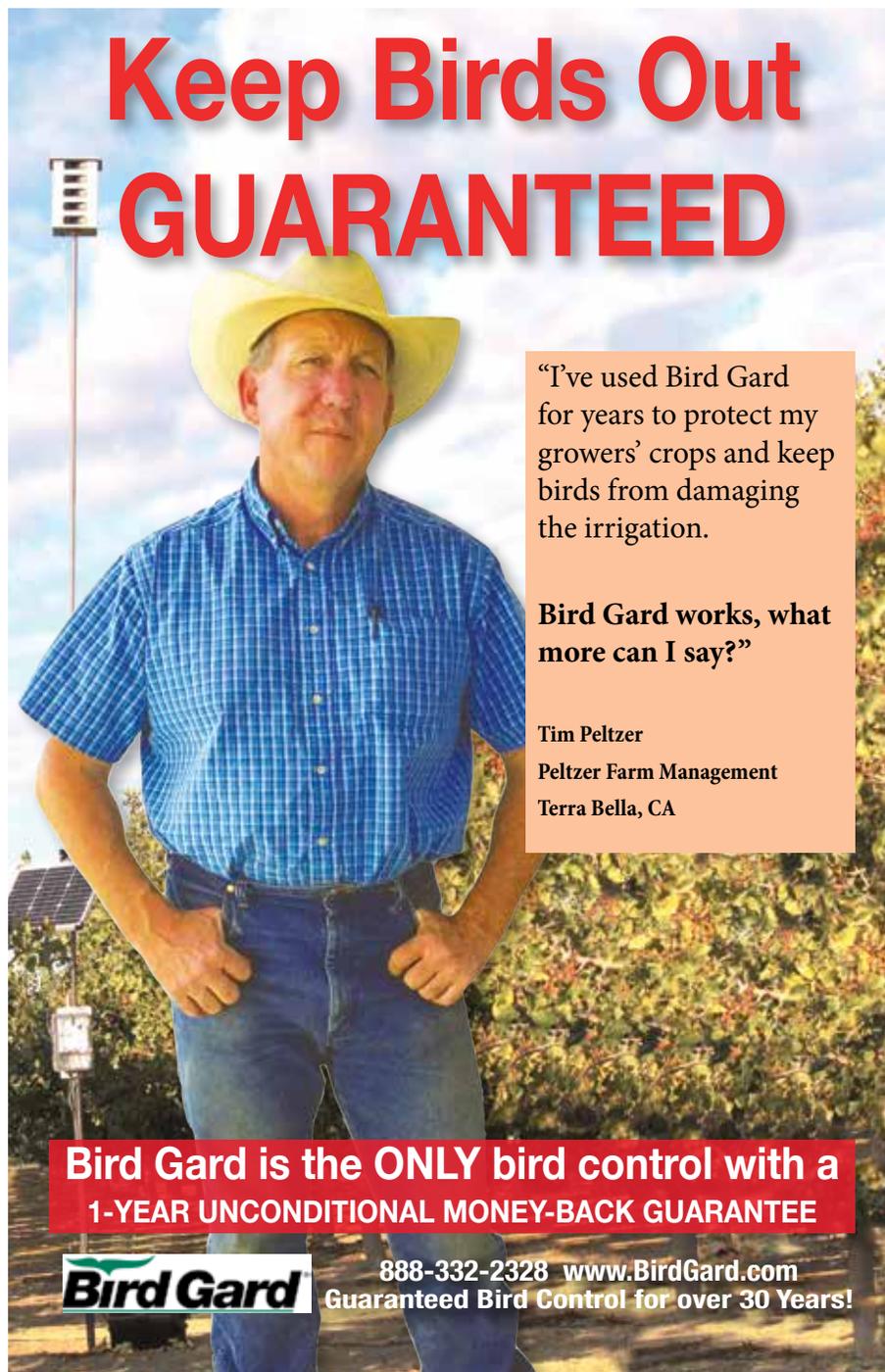
Research

Wilson has been part of a research effort to find an effective trap and attractant for LFB to improve monitoring. This information can fill a critical gap in control as predicting population densities and overwintering survival early in the season can assist with control efforts.

While use of pyrethroids has been an effective control measure, resistance to that material has built in navel orangeworm and growers are using more targeted pesticides that are not as effective as pyrethroids on LFB.

He said the hanging panel trap is currently being used as a platform to test various types of lures. Lures are both pheromone based and host plant volatile based.

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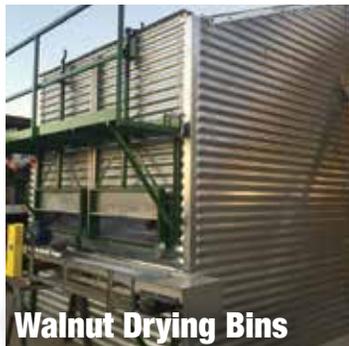
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FARMERS ARE LIKE ATHLETES. However, your opponent is good ol' Mother Nature. Like an athlete you have to prepare for the coming season, fight through pain and injury, while anticipating every move your opponent is going to make. Every athlete I know has always looked for that edge to get them to peak performance. Protein, energy drinks, recovery solutions, heat and cold therapy. When mother nature is on her game, she has the best curve ball in the business. But today, the astute farmer has a much better chance of hitting it.

Solutions to Soil Amending

There aren't any simple solutions to soil amending. Our trees remove a lot of soil nutrients. We have to find ways to replenish them and make more available. Mother Nature doesn't know that we have stolen her playbook and taken some cues from her coach. God made soil biology to do a lot of the work for

Continued on Page 74



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Continued from Page 72

our plants. They weather and mine nutrients all the time to make them available for our trees to drink. Detritus, incorporated into the orchard floor becomes future crops' organic matter. "Organic Matter (OM)" is the net that keeps structure, stabilizes nutrients, sequesters carbon dioxide and holds water in our soils. Increasing OM is an ongoing process.

In the fall, most of my farmers apply decent amounts of compost to their orchards. Many of them are now incorporating cover crops into their middles. Treating this as a two-step approach to building soil organic matter is a huge benefit to creating better and more active soil with more benefit than either of them separately. More active and fertile soil helps ensure our trees have the building blocks they need to flourish.

Carbon

Why? Carbon. We always talk about 16 nutrients critical to plant health. Nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), are the big 6 right? Well, if those are the big 6 we seldom reference the humungous 3. C,H, and O. Like the human body, carbon, hydrogen and oxygen comprise almost all of a

living tree by weight.

In a message from Jay Hayek, an Extension Specialist from Illinois with the Forestry Department, he quoted Dr. Jeff Howe:

"It varies by species and other factors; however, it is often reported that live trees are approximately 50 percent water by weight and 50 percent carbon (oven-dried weight). More precisely:

"Dry (moisture-free) wood is about 48-50 percent carbon, 38-42 percent oxygen, 6-7 percent hydrogen and a number of other elements, such as nitrogen and sulfur in very small percentages. These percentages are based on the weight of the elements as a percentage of dry wood mass. Living trees, however, are very wet. In fact, although there can be great variation between tree species (and seasonally), a living tree may be made up of more than two thirds water by mass. Thus, a living tree is made up of 15-18 percent carbon, 9-10 percent hydrogen, and 65-75 percent oxygen by mass." Source: Jeff Howe, PhD

We spend so much time trying to get the 16 right that we let carbon slip through the cracks. Our trees "breathe" carbon dioxide from the air and assimilate carbon upstairs. But downstairs, they need the love as well. And all that soil biology is depending on it.

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Do the Math

Lets do the math: 3 tons of quality compost will cost you about \$120 per acre. By quality, I mean that it has been cured for at least 1 year (more if you can get it). When it arrives and you lift the tarp or open the gate, make sure it doesn't wreak of ammonia. That isn't cured compost. It can do more harm than good to

"We always talk about 16 nutrients critical to plant health. Nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), are the big 6 right? Well, if those are the big 6 we seldom reference the humungous 3. C,H, and O."

upset the balance of a stable and active biology. Cover Crop seed, depending on species, will cost you between \$25-\$50 per acre plus planting costs. Lets say an additional \$20 per acre in labor and diesel. On the high side that'll add up to less than \$200 per acre. Now for the benefit. A good cover crop out here in the West such as beans, peas, vetch and barley can get to two feet high. That massive amount of green matter can be as high as six tons per acre dry matter. When that is disked in you've just added a total of nine tons of cured compost and green waste to your soil. Studies have shown a good cover crop can also release up to 50 units of Nitrogen eight weeks after incorporation. That amount of organic matter reconstituted into low OM soils can have dramatic effects in a few short years.

Lasting Benefits

Increases in soil organic matter will have so many lasting benefits. Soil structure improves. Tilth improves. Soil biology improves. Weed control improves. Nutrient and water holding capacity improves. Nutrient incorporation and assimilation improves dramatically as soil biology flourishes.

When Mother Nature serves up another drought pattern, improved water holding capacity can ensure a higher yield. A weather pattern conducive to phytophthora in wet conditions can be diminished by a soil structure that moves water effectively through the profile. Pythium, nematodes and fusarium can be thwarted by active biology competing with them or eating their eggs. Mother Nature is relentless to farmers. But we are a tough breed. We never stop learning. Working hard has never been an issue for a farmer. Prepare, plan and perform. Countering Mother Nature's detrimental moves by building our soil health will give us that edge. Having our soils at peak performance will take that next curve ball she throws and hit it out of the park.

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All photos courtesy of the American Pecan Council.

Taking Super-fy to Superweeks

By ALEX OTT | Executive Director of the American Pecan Council

AS FALL APPROACHES, pecans are typically top of mind, particularly when it comes to pie and the holiday season. However, as the American Pecan Council works to raise demand for pecans nationwide, we know a critical piece of our efforts is finding creative, engaging, and research-driven ways to reach our target audience outside of harvest and the holidays.

We have previously shared with you our overarching campaign to harness the year-round superfood power of American Pecans. The Super-fy marketing campaign leverages the idea that pecans' powerful nutrition makes them the perfect addition to any snack or meal. From January through March, Super-fy drove interest and engagement with our target audience, and was fueled by work with blogger partners, media relations, and social media.

While the Super-fy campaign concept highlights the nutrition of pecans to our target audience, we also wanted to showcase pecans' versatility. To take our message a step further, we introduced Superweeks in April. An evolution of Super-fy, this campaign was a meal-planning concept designed to show that pecans are a versatile ingredient, perfect for creating unique and delicious recipe combinations. Pecans can be incorporated into meals all week long and are worthy of a spot on weekly family shopping lists.

The Research Behind Superweeks

Before we launched Superweeks—or

embark on any marketing campaign—we began with an understanding of our audience's motivations and tailoring a program to appeal to their interests. So, who is our target audience, and what do they care about most?

While we want everyone to become a pecan lover, we are focused on Generation X and Y mothers, who hold purchase-decision power for meals and groceries in their households. Our research uncovered that these mothers are not only health conscious but are the most likely to look for new ways to incorporate nutrients into meals for their families.

We combined this insight with our goal of increased awareness. Because our initial consumer research informed us that many Americans think of pecans as a baking ingredient, instead of a nut, our programs continue to strive for greater awareness of pecans' versatility.

We also learned that two out of three moms plan their weekly meals in advance, especially those with young children at home. In fact, according to Mintel consumer research, the most stressful time of the day for parents is dinnertime—and 82 percent of working moms try to combat this with advanced meal planning.

All of these factors—purchasing power, interest in trying new and healthy things, and a tendency to pre-plan their ingredient purchases—laid the foundation for a campaign that showcases The Original Supernut as a healthy, hardworking ingredient. And what better time to

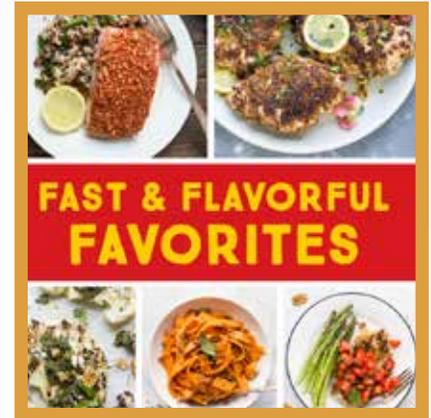
introduce the idea of cooking with pecans than when our target audience is planning their week? In order to prove pecans deserve a spot in her regular rotation, we needed to bring our audience content in the context of her meal-planning routine.

Developing our Themes

We knew we wanted to create a variety of meal plans that appealed to all kinds of needs and interests, while still keeping all options family friendly and recipes easy to understand. Each of the meal plan themes had extensive research behind them to ensure they fit a lifestyle interest or dietary need of our target audience.

Consumer research helps guide this process, and ensures that the content we are creating is the best fit for who we are trying to reach. For example, according to Mintel consumer research, mothers in Generation X and Y seek meals that may accommodate certain dietary restrictions, such as gluten intolerance. Therefore, several of our meal plans feature a variety of recipes that are all gluten free, showcasing the pecan's versatility as a delicious option for all.

Research also showed that moms are looking for options that will fuel their families throughout the day, but we know that many consumers just think of pecans as a baking ingredient, not superfood fuel. So, we created our energy-themed plans, chock-full of on-the-go options and quick dinners that fight sugar slumps and afternoon grogginess. And for the 53 percent of consumers that





"Our plant-based plans showcase pecans in an entirely new light as a staple source of plant protein for kids and parents alike."

say they don't have the energy to think about cooking, we have plans that take thirty minutes or less to prepare!

We also continue to cater to the broader, up-and-coming consumer trends. Plant-based eating has grown nearly 600 percent in the last several years, and is continuing to grow—and as a source of plant protein, pecans have a powerful role to play. Our plant-based plans showcase pecans in an entirely new light as a staple source of plant protein for kids and parents alike.

Together, each individual plan creates a suite of options for all kinds of health and lifestyle priorities.

Sharing Superweeks

Creating and sharing these plans began with a foundation of strong blogger partnerships to help develop new recipes and meal plans. To ensure that this new content would resonate with our target audience, we chose to work with bloggers who are actually a part of our target audience.

Once recipes and meal plans were created, we promoted our campaign through a variety of tactics and channels. From broadcast TV cooking demonstrations with Registered Dietitians (RDs), to social media, to search engine advertising, we targeted our efforts to reach our audience every step of the way.

Since this campaign focuses heavily on planning for a shopping trip, we deployed some new tactics to reach our consumers right at their point of purchase by working with resources most

directly tied to grocery stores and the shopping experience. What better time than to introduce the idea of cooking with pecans than when our target audience is planning their week of meals?

One such way was through partnerships with retail dietitians, which are RDs that work in grocery stores nationwide. These RDs help educate shoppers on nutritious products that they should consider when shopping for themselves and their families.

To arm these influencers with the information and educational materials they need, we sent them our American Pecans Retail Dietitian Toolkit. This informational packet includes information about pecans' nutritional profile as well as turnkey activations that RDs are able to active in-store, engage shoppers and elevate total store sales. From recipe inspiration, and ideas on how to take advantage of special events and holidays like National Nutrition Month in March and of course, National Pecan Month in April, the toolkit provides 12 months of activation ideas, store and media messages, examples of social media posts, and newsletter and blog inspiration.

American Pecans expanded the program with a themed e-blast newsletter in May and June through the Retail Dietitian Business Alliance, a key resource for more than 2,200 retail RDs nationwide. Within the e-blasts, we provided an opt-in link for RDs who would like to receive the physical toolkit,

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Continued from Page 77

alongside nutrition handouts with themed Superweeks 5-recipe meal plans that they can distribute to consumers in-store, helping to keep pecans top of mind while they're grocery shopping and driving purchase.

We also hit the grocery store shelves to help spread the word. American Pecans are featured in the summer issue of Kroger's in-store magazine, *Live Naturally*, sharing the heart-smart benefits of pecans alongside a recipe for Pecan-Crusted Salmon. In a previous Kroger survey, 93 percent of readers say they have been inspired to try new products based on content they saw in the magazine.

These are just a couple examples of the widespread activation approach we have taken to make Superweeks come alive for our target audience and beyond. Each of these initiatives is tailored to appeal to our target audience both while she is gaining initial inspiration for her weekly meal plan, and while she is actually



REFUEL WITH SUPERFOODS



PECAN CRUSTED CHICKEN

shopping and nearing the point of purchase. In doing so, we are ensuring that pecans are top of mind across the entire consumer journey.

Want to Get Involved with Superweeks?

As we continue to build and develop

our marketing work, we will always ensure that the resources we are creating are designed for the pecan industry, and available for growers and shellers to harness for your own business growth.

The Digital Toolkit on AmericanPecan.com houses resources available to you 24/7. Within the specific Superweeks page (password: pecans18), you can find consumer-facing resources such as heart-smart shopping lists, printable recipe cards, and even a "How to Choose and Store Pecans" handout to help your customers while they're in the store.

Subscribe to the American Pecan Council newsletter, "In A Nutshell," to stay up-to-date on the latest marketing activity from American Pecans and how you can get involved. Interested in better understanding our progress? Our monthly Marketing Highlights report is available through the newsletter and also for download through the "Your Dollars at Work" section of the Digital Toolkit.

As we continue to grow and develop our marketing work, your feedback is very important to us—we want to know what you think! Whether you have questions about Superweeks, or you're in the pecan industry and want to know how to best use the brand for your business, we're here to help. Reach us via email at industry@americanpecan.com, or via phone at (817) 916-0020.

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A WORD FROM THE BOARD: THE ALMOND BOARD OF CALIFORNIA



IMAGINE THIS: YOU WAKE UP AFTER A RESTFUL night's sleep in your family's RV. You get ready for the day and walk less than five minutes to the largest event in the world dedicated entirely to almonds, where you hear leaders in the almond industry speak about the past year's successes

and challenges, and the opportunities ahead. You catch up with fellow growers and pest control advisors (PCA), meeting old friends and making new ones, in between sessions on irrigation scheduling and the California Almond Sustainability Program. You speak with a University of California (UC) Davis researcher, an equipment manufacturer and a solar company all in one afternoon, after which you enjoy a glass of wine on the trade show floor.

Where Are you?

You're at The Almond Conference 2019, the California almond industry's "Best of Show," blue ribbon event.

The Almond Conference is the largest international gathering focused solely on almonds, last year drawing nearly 4,000 people from 30 countries and 35 states. Held this year on December 10-12, the annual event provides growers and processors the opportunity to interact with researchers and influential industry members to discuss a variety of research projects, production news, global marketing efforts, regulatory issues and more. The conference also features workshops and poster sessions dedicated to research topics, as well as a bustling exhibit hall where industry members can see the latest in equipment and technology firsthand.

This year's Almond Conference will take place at Cal Expo, home of the California State Fair.

"This year's conference will take on the look and feel of the State Fair," said Daren Williams, Almond Board of California's (ABC) senior director of Global Communications. "So bring the whole family and comfortable shoes and clothes. Orchard attire is encouraged!"

Move to Cal Expo for 2019

Following The Almond Conference 2018, the City of Sacramento began a large-scale remodel and expansion of the Sacramento Convention Center, the host site for The Almond Conference (TAC) for the past seven years. The remodel will significantly update the facility and provide much needed improvements, offering the Almond Board a truly state-of-the-art venue for future conferences.

However, to undertake and complete this effort, the City of Sacramento closed the Convention Center for a year, requiring The Almond Conference to move venues for 2019. After reviewing more than a dozen site options, the Almond Board of California conference management team choose Sacramento's Cal Expo, the site of the California State Fair, for The Almond Conference 2019.

"There's no doubt about it: Cal Expo is a very different venue than the Sacramento Convention Center, but that excites us! The conference planning team has fully embraced what Cal Expo has to offer, which is why we selected the 'Best of Show' theme that ties into the home of the California State Fair. Cal Expo provides ample space for our growing exhibits, convenient parking and endless opportunity to have fun and try some new things," said Jenny Nicolau, senior manager of Industry Relations and Communications at the Almond Board.

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TAC 2019 a Year of Lodging, Foodie Firsts

With a new location for 2019 comes great opportunity for the Almond Board to provide industry members with experiences unique to the location and layout of Cal Expo. While room blocks for hotels in downtown Sacramento will still be available for industry members, ABC is also providing attendees with hotel options near Cal Expo, as well as a limited number of spaces to stay onsite in Cal Expo's RV Park. The RV Park is located only a few steps from the conference show floor, and staying near or on-site at Cal Expo places attendees right across the street from Sacramento's Arden Fair Mall and restaurants, and even provides close access to the American River Bike Trail and Parkway. Still, for those attendees who would prefer to stay in hotels downtown, shuttle buses will run between Cal Expo and those hotels throughout the day. Hotel room blocks will open on September 10 at 9:00 a.m. Pacific Standard Time (PST).

Lodging isn't the only thing the Almond Board is bringing on-site this

year. In addition to the plated lunches provided during keynote speaker sessions, taco trucks will be on location at Cal Expo, offering a variety of local cuisine to attendees.

But wait, there's more: ABC Almond Leadership Program participants' Dominique Camou and Lucas Schmidt's "On the Fritz" Almond Brown ale will be sampled in the new almond lounge for industry members to enjoy!

Each year, Leadership participants work on a special project that they then present to their classmates, mentors and the ABC Board of Directors. The purpose of the project is to challenge participants to take a deep dive into a topic that interests them, to try a new technology or innovative practice on their operation, or, as is the case with Camou and Schmidt, to explore a new or novel idea that advances the industry in some capacity.

The duo hosted an "On the Fritz" tasting at Temblor Brewing Company this June, inviting local industry and community members to attend and donating all proceeds to California

Future Farmers of America (FFA). Now, at this year's conference, "On the Fritz" will be available for industry members and attendees from around the globe to enjoy.

"It's crazy to think that what started off as an idea we thought of on the second day of class has evolved into this larger opportunity to share our special project with attendees of The Almond Conference in a very tangible—and I think, tasty—way," said Camou, who works as a grower relations representative at Famoso Nut Company, LLC. "We can't wait to hear the industry's feedback on our new almond beverage!"

Conference Features CASP Anniversary, Second Exhibit Hall

All attendees are encouraged to attend the State of the Industry address, which will be held on the morning of the first day of conference, December 10. During this address, ABC President and CEO Richard Waycott and ABC Board Chair Holly A. King will first share advances

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made and challenges overcome in the last year. Then, in addition to talking about the Almond Orchard 2025 Goals and how the industry is moving toward the almond orchard of the future, the State of the Industry address will highlight the ten-year anniversary of the California Almond Sustainability Program, or CASP. This program uses grower-submitted production information to demonstrate the sustainability of our industry to buyers, regulators and consumers, and helps growers find ways to improve efficiencies. Now in its tenth year, CASP represents 25 percent of the almond acreage in California. The Almond Board encourages all growers to get involved with the program to further improve their on-farm practices and report the good things they're doing in their orchards. For more information on CASP, growers should visit SustainableAlmondGrowing.org.

Attendees should also note that this year there will be three content tracks instead of four.

Beyond the sessions, this year's Almond

Conference will feature two exhibit halls. Because the original exhibit hall sold out mere days after The Almond Conference 2018, the Almond Board is opening up a second exhibit hall that will not only expose attendees to more services and equipment, but also provide industry members with increased networking opportunities and even more areas to do so, with more seating options than ever. There will also be an increase in time designated for research posters sessions, during which attendees may visit the rows of research posters and speak with researchers one-on-one to discuss their findings, from in-orchard discoveries to learnings gained at a processing facility.

FFA Takes on Larger Role

Each year, multiple California FFA chapters from across the Central Valley volunteer at The Almond Conference to provide a variety of services, including welcoming attendees, replenishing industry collateral at the Almond Board booth and scanning attendee's badges as they enter sessions and meals. The students' experience at The Almond Conference

gives them an opportunity to meet a wide array of individuals who are passionate about almonds and the broader agricultural sphere, and be exposed to the latest industry research and information in one place, at one event.

Recognizing that today's youth are tomorrow's leaders, the Almond Board is increasing its work with California FFA in a rather creative way: ABC is hosting an Almond Photography Contest for FFA students with a knack for photography. Leading up to The Almond Conference, FFA students will have an opportunity to submit an image that captures the essence of the almond industry and/or one aspect of the industry to ABC to be considered for the grand prize of \$750 and two tickets to a TAC luncheon. More information is available at AlmondConference.com under the "Agenda" tab.

TAC 2019 Offers More, More, More

From new food and drink options to a second exhibit hall for even greater trade show time, The Almond Conference promises to be a one-of-a-kind, "Best of Show" event for the California almond industry.

"I think a reoccurring theme with this year's conference is "more"—more optimized session structure, more food options, more time with vendors and researchers and more opportunity for continued learning and growth as an industry," said Nicolau. "Just as the California almond industry strives to produce more product to meet more demand while also being more efficient and responsible, so the Almond Board strives to constantly improve and evolve the annual conference in a way that provides more to the industry and seeks to constantly put their interests first."

For more information about The Almond Conference, industry members are encouraged to visit AlmondConference.com. And don't forget: registration is open now at AlmondConference.com, and hotel blocks become available on September 10 at 9:00 a.m. PST.

We'll see you on December 10!

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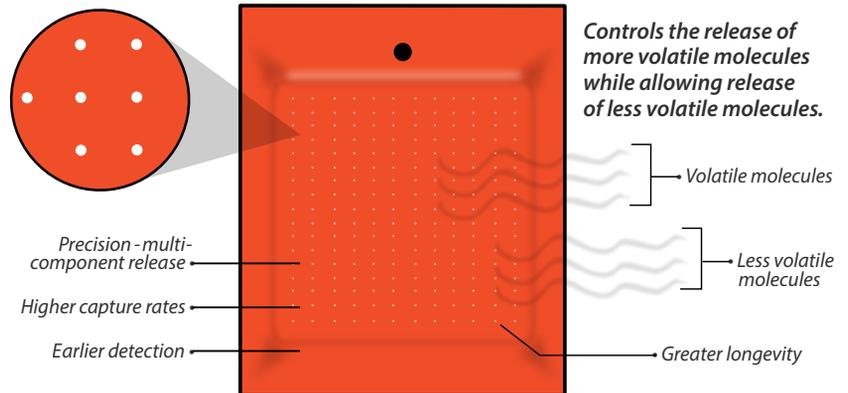
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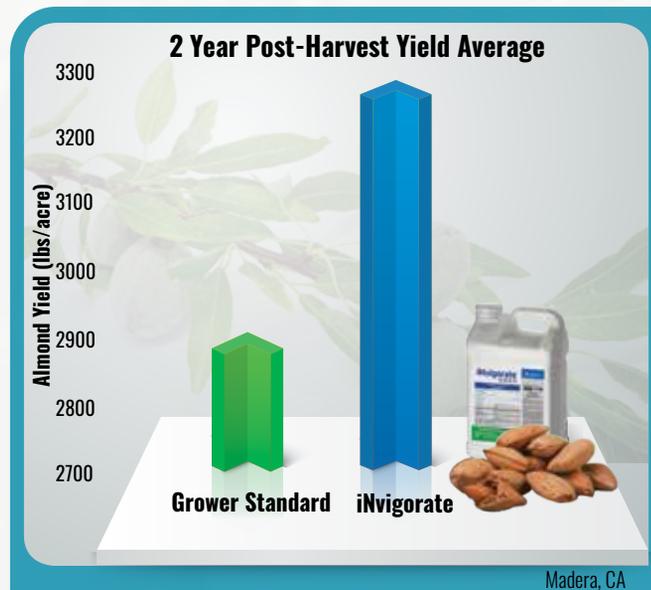
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