

WEST COAST NUT

October 2018 Issue

SPOTLIGHT:

Winter Sanitation—
Protect Yourself from
NOW

See page 4

In This Issue:

Key Points for Avoiding Aflatoxin
Contamination in Almonds

Optimizing Your Orchard Spacing

Pasteurization—A Decade Later



South Valley
Nut Conference

OCTOBER 26, 2018

See page 54-55 for agenda details

Mid-Valley
Nut Conference

NOVEMBER 2, 2018

See page 24-25 for agenda details



NOVEMBER 28, 2018

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WEST COAST NUT

By the Industry, For the Industry

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FEATURED ARTICLE

As the 2018 pistachio harvest comes to an end, it is time for growers and managers to take a look at improving their orchard sanitation practices. Shaking mummy nuts from trees, blowing mummies or trash nuts out of tree crotches and cracks; ruts and rodent holes, and into the middle of the rows where the nuts can be destroyed is a first step in breaking the reproductive cycle of navel orangeworm (NOW).

See the full story on page 4





WINTER SANITATION

Protect Yourself from NOW

By: Cecilia Parsons | Associate Editor

As the 2018 pistachio harvest comes to an end, it is time for growers and managers to take a look at improving their orchard sanitation practices. Shaking mummy nuts from trees, blowing mummies or trash nuts out of tree crotches and cracks; nuts and rodent holes, and into the middle of the rows where the nuts can be destroyed is a first step in breaking the reproductive cycle of navel orangeworm (NOW). This highly destructive pest, *Amyelois transitella*, overwinters as larvae in nuts left behind after harvest. Navel orangeworm larvae feeding damages kernels and can introduce aflatoxins which threaten lucrative export markets. Effectively destroying the windrowed mummy is the big challenge in pistachio orchard sanitation.

Sanitation efforts in almond orchards are carried out much the same way as pistachios, but are more effective due to variable ground conditions in pistachio orchards and the physical differences

of the nuts. The smaller pistachios have tougher shells make them difficult to pick up and destroy.

Current Tools

Given the current tools available, “Sanitation will provide a benefit, but it won’t have the same impact in pistachio orchards as it does in almonds,” said Brad Higbee, research & development manager at Trécé Inc.

There is no current University of California (UC) research on numbers of pistachio mummies left in orchards and the relationship to NOW populations the following year. A good pistachio sanitation guideline is 10-20 mummies per ten trees. Justin Nay, crop advisor with Integral Ag of Chico said fewer than 40 mummies per tree reflects acceptable sanitation efforts. In almonds the standard sanitation goal is one mummy nut in the tree per ten trees and 5-10 on the ground.

“What we see in pistachios is 100-200,” Higbee said. “There is a lot of room for improvement.”

Area-wide sanitation efforts are more effective in lowering NOW numbers. If neighbors do no sanitation in their orchards, NOW infestations grow and move into nearby orchards, even those with good sanitation.

NOW Damage

The percentage of NOW damaged or rejected nuts was high at two percent last year. With higher numbers of NOW overwintering, pistachio growers were expecting to reach that point again this year. Nay said trapping early in the growing season showed high numbers of NOW. Numbers declined in June, but came back to hit the early split nuts. Late harvested pistachios are at a higher risk of NOW infestation.

Most pistachio growers recognize the

Blowers are an option. Goddard said they can be used to blow the nuts into the next row where the mower can make a pass and destroy them. The 128 crop chop knives in the mower pass over the shear bars 33 times per second.



value in good orchard sanitation, with processors offering bonuses for low damage percentages. Still, some growers choose to leave mummy nuts behind in their orchards. Others cannot do an effective job of sanitation due to orchard limitations including uneven floors, high berms and vegetation. Early harvest, timed pesticide applications and mating disruption are other practices that help with NOW control, but Nay said orchard sanitation remains a key part of the control strategy.

Fall Timing for Sanitation

Good orchard sanitation in the fall is proven to reduce the number of overwintering NOW, breaking the bridge between the final generation of the year and the first generation of the next year. That first generation invades early split nuts, setting the stage for higher numbers at harvest when the crop is vulnerable to damage.

Fall timing for sanitation is best due to a peak in egg laying during hull degradation. The mummies may also

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Mark and Jim Goddard with Rears Mfg. Co's pistachio sanitation mower. This piece of equipment was designed specifically to address sanitation challenges in pistachio orchards. Oregon-based Rears began limited production of this machine in 2014 and Jim Goddard said growers are showing interest due to navel orangeworm damage potential with high numbers of mummy nuts left in the orchards. Photos courtesy of Cecilia Parsons.

Continued from Page 5

be more susceptible to environmental factors including desiccation and fungal attacks. Growers who wait until winter, may find they cannot sanitize due to wet orchard floors.

Warm, dry winters make it more difficult to break that bridge by enabling more NOW to survive. Research and experience has shown that mummy nut destruction in the fall may be more effective than efforts during the winter months as the percentage of NOW larva in the early instar stages should be greater.

Nay said following final harvest shakes in the orchards, pistachio growers and advisors should be prepared to scout their orchards and determine the level of mummy nuts left behind. Nut clusters that remain after shaking do eventually



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fall and others come down with pruning or hedging. The remaining nuts should be blown to the centers and destroyed by the end of the year. Cleaner orchards will need fewer pesticide applications as populations will be lower at the beginning of the season.

Even though many of the nuts left behind after harvest are blanks, growers should not assume they all are. Nay said it becomes obvious when they begin to sprout during the spring.

Good Sanitation Pays

Implementing good sanitation practices and paying attention to orchard conditions that contribute to successful overwintering of NOW will pay, Nay said, as processors reward for low damage percentages and by reducing spray application costs.

Cracking few hundred tree mummy nuts can provide an idea about the extent of larval infestation on those

remaining mummies, and this information may be helpful when planning for in-season control measures.

Nay cited an example of one ranch that invested in a very strict sanitation strategy, smoothing orchard floors and sanitizing to lower mummy nut numbers to fewer than three per tree. That strategy paid off, Nay said, with low NOW trap numbers and reduced pesticide applications for the next two years. This was a unique situation with an isolated orchard, Nay said, but the extra effort paid off.

Weeds in the orchard can affect sanitation efforts. Weed species attract rodents that make holes in orchard floors where mummy nuts can collect. Drip hoses holding mummies in place are another problem. Nay said discing orchard floors for weed control, especially when the ground is soft, can create additional problems, leaving ruts and dead furrows where mummies collect. Discing just the middles or cross discing is not effective sanitation as it buries the nuts

rather than destroys them.

The final challenge in orchard sanitation, after corralling all the mummy nuts in the center of the rows, is destroying them by leaving the mummies in pieces too small for NOW overwintering.

The Challenge With Mowing

Flail mowers are not exactly the right tools for pistachio mummy nut destruction, Nay said. The orchard floor needs to be smooth, hard and level for the best sanitation job and even then not all mummies will be destroyed by a flail mower.

Conventional flail mowers can do a better job on almond sanitation because the shape and size of the nuts make them easier to destroy. Orchard floors are also managed to be smoother to pick up nuts at harvest. Pistachios present problems due to their size and shape.

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To be effective, the knives have to be more destructive and the machine has to keep the nuts inside longer for the destruction process. Rears Mfg. of Coburg, OR introduced a machine in 2014 that aimed to address the issues in pistachio sanitation. Growers are giving the Sanitation Mower good marks, but note that orchard floor management plays a part in successful destruction of pistachio mummies.

Jacob Mendrin with the Specialty Crop Company in Madera said the Rears sanitation mower does a decent job of busting up the shells and destroys more mummy nuts than a conventional flail mower.

Mendrin said the ground conditions pay a large part in the effectiveness of the sanitation mower. Orchard floors with excess vegetation trash and grooves and ruts make it difficult to destroy the mummies.

It also depends on how high the knives are set, Medrin said. Guys that like to conserve them, will set them higher so they will last longer. Others will put them right on the dirt to cut up the nuts.

Jamieson Rear of Rears Mfg Co. Inc. said the folded cup knife used on most conventional flail mowers is not aggressive enough to destroy pistachio mummies. That action is important, because the tool must pulverize the mummies to eliminate their use as an NOW overwintering site.

Rear said there is also not enough interference in the blade path of the conventional orchard mower, leaving nuts to flow through the housing largely unimpeded. In addition the discharge opening should be restricted, sending nuts back into the shredding cavity. An effective machine has to be designed specifically for pistachio mummy destruction in one pass to be economical. In addressing the limitations of the conventional flail, three rows of interference in the shredding cavity increases turbulence and the amount of nut impact. Fewer intact mummies are blown out of the mower due to a recycling door that restricts discharge.

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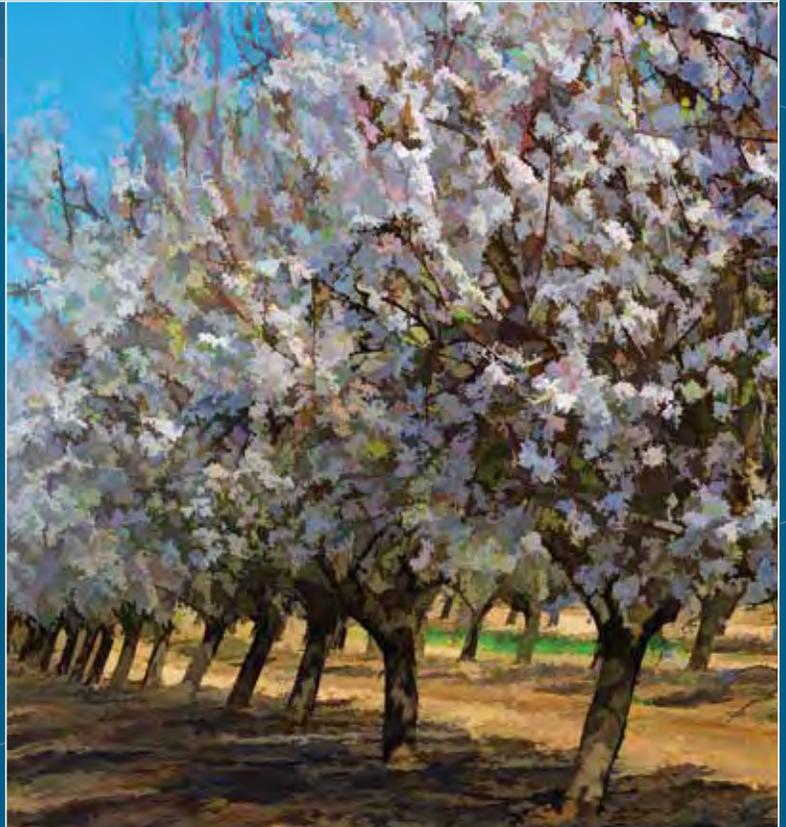
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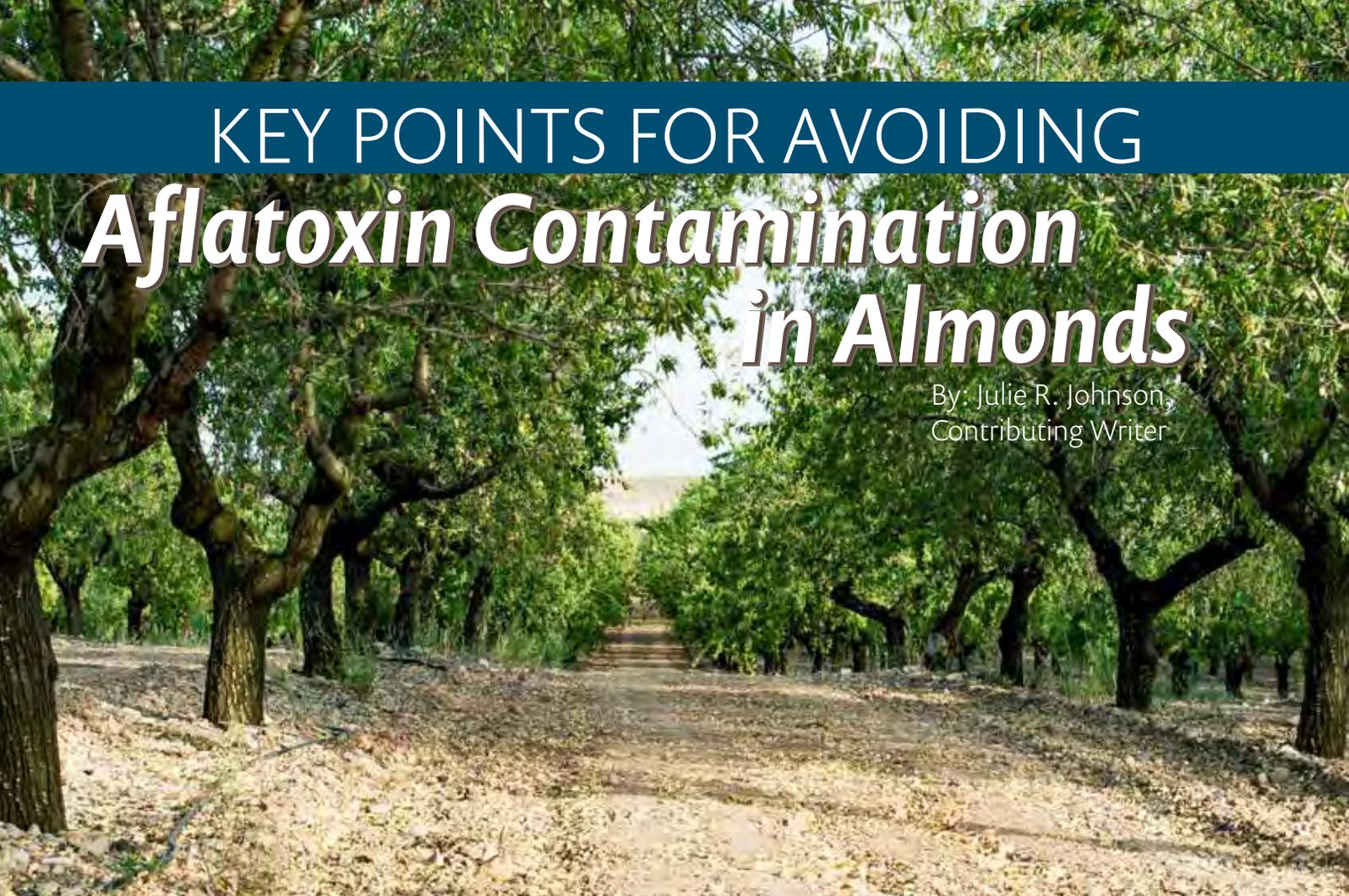
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KEY POINTS FOR AVOIDING

Aflatoxin Contamination in Almonds

By: Julie R. Johnson,
Contributing Writer

“
Aflatoxin
is a type of
mycotoxin,
a naturally
occurring
chemical
produced
by certain
molds
”

An increase in insect damage, specifically from navel orangeworm (NOW), created a concern for an increase in aflatoxin contamination in this year's almond crop, according to Tim Birmingham, the director of Quality Assurance and Industry Services for the Almond Board of California.

“We had a year when we had higher insect damage than we have had in previous years, and we know it is in that insect-caused damage that aflatoxins are most commonly found,” he added. “Aflatoxins and insect damage correlate very closely. We know that the majority of the aflatoxin mass is found in the insect damaged nuts.”

Aflatoxin is a type of “mycotoxin,” a naturally occurring chemical produced by certain molds, mainly *Aspergillus flavus* and *Aspergillus parasiticus*.

It was discovered in the 1960s when a flock of turkeys in England died after eating contaminated feed. Molds associated with aflatoxins are common in nature, affecting a number of crops, including nuts and grains. The strains of aflatoxin most commonly found in foods include B1, B2, G1 and G2.

Aflatoxins have been proven to be a carcinogenic when consumed by humans and are capable of raising risks for cancer and other illnesses. Because it is a carcinogenic, aflatoxin has gained the attention of researchers both in the medical and agricultural communities.

“The FDA (Food and Drug Administration) has established limits or tolerance of aflatoxin in almonds to 20 parts per billion total,” Birmingham said. “In other parts of the world, that number is higher and lower.”

Understanding the risks associated with aflatoxin, the Almond Board of California

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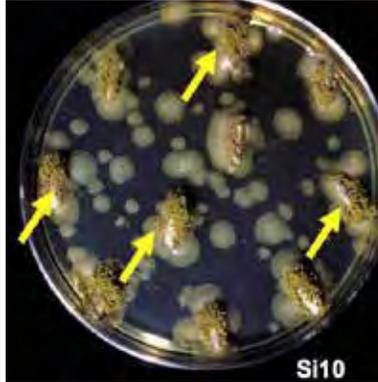
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consistently utilizes its resources to educate almond growers and processors, Birmingham said.

“Educating growers and handlers is an ongoing process,” he added. “Our efforts include educating growers about their role to produce a low insect-damaged product. But it doesn’t end there—we are also working with hullers and shellers to make sure they are stockpiling the product properly so they don’t create conditions where the mold can grow and produce aflatoxin.”

The board has issued stockpiling management guidelines.

“And then, taking it further into the processing facility, we work with the handlers to make sure they understand the need while sorting the product, electronically and by hand, to remove insect damaged product that will help reduce the level of aflatoxin in the product,” Birmingham said.



There is a direct link between aflatoxin contamination in almonds and damage created by insects such as the navel orangeworm. Photos courtesy of Themis Michailides, UC Davis plant pathologist at Kearney Agriculture Center.

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Navel orangeworm control can be achieved in almonds by careful orchard sanitation, early harvest of the 'Nonpareil' variety and postharvest fumigation with insecticides. *Clockwise from top left:* a navel orangeworm adult; a fertile navel orangeworm egg laid on a mummy almond; a hatched egg; and an almond mummy infested with navel orangeworm larvae. Photos courtesy of Themis Michailides, UC Davis plant pathologist at Kearney Agriculture Center.

Going back to this year's NOW problem, he couldn't say specifically what the cause for the increase in NOW infestation is.

"We had many years of very low insect damage, somewhere around one percent or even lower and then this year we had a doubling of that," Birmingham added. "There may be some environmental elements and weather at play here of course. We (the Almond Board) are hoping this is an anomaly."

He is emphatic that the state's growers have been implementing good practices to address insect control.

"We have a record of that, and now, all of a sudden we hit this bump in the road. A bump that could lead to an increase in mold contamination resulting in an increase in aflatoxin," Birmingham said.

Orchard/Pest Management

One of the key components for growers in the fight against aflatoxin contamination is through good orchard management practices. In this battle, pest control, sanitation and cleanliness matter.

In almonds the source of the contamination is from insects, such as NOW, and the damage they cause, the soil, and mummy nuts.

The Almond Board recommends careful winter sanitation, including the removal of mummy nuts before bud swell or be Feb. 1. Mummy nuts are the prime harborage of overwintering NOW, and their removal is the most efficient control method. Once removed, the mummy nuts must be destroyed by March 15.

Early harvest, and not leaving split nuts on the tree is another important management practice in the fight against aflatoxin. Harvest almonds as soon as possible after they mature and promptly remove them from the orchard after they have dried for the required period of time. Through this practice, a third generation of NOW egg-laying is avoided.

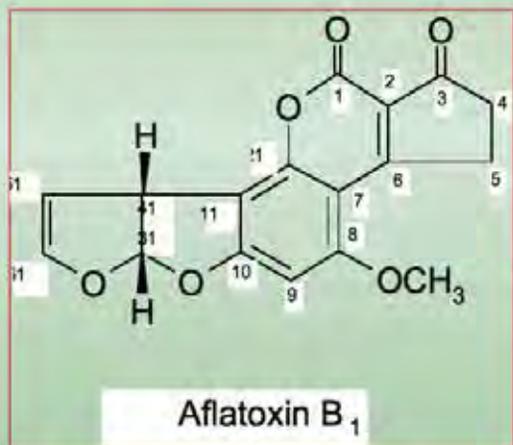
If winter sanitation and early-harvest guidelines are followed, an in-season NOW treatment may not be necessary. However, with this year's high NOW pressure, all precautions may be in order. A harvest sample can help determine if treatments are required.

As feasible as possible, keep the orchard floor free from sources that can produce molds and other pathogens. Keep it as level, smooth and dry as practical, and remove any unnecessary debris. In

Continued on Page 14

Aspergillus flavus and *A. parasiticus* produce:

Aflatoxins: B₁, B₂, G₁, G₂, M₁



**B1 is the most potent;
it can cause liver cancer**

The molds *Aspergillus flavus* and *Aspergillus parasiticus* produce aflatoxin B1, B2, G1 and G2—with B1 a strong carcinogenic and cancer risk. Photo courtesy of Themis Michailides, UC Davis plant pathologist at Kearney Agriculture Center.

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In addition, remember to keep equipment clean and avoid cross-contamination from one orchard to another.

Harvest and Delivery Guidelines

Critical care should be taken during harvest to avoid potential sources of contamination or conditions resulting in the development of molds that lead to aflatoxin.

If rain is forecast, don't shake. After a rain, wet nuts dry faster on the tree than on the wet orchard floor.

If rain is forecast and nuts are harvested but too wet to pick up, blow them away from the tree trunks but

don't windrow. Extra time should be given to ensure the nuts are properly dried prior to sweeping up, and nuts should be turned to allow proper drying.

Current research shows conditioning the crop even before rain and under normal dry conditions facilitates drying. Conditioning means the nuts are picked up, the leaves and dirt are blown out and the nuts are dropped back on the orchard floor. Removing leaves and other trash also helps the nuts dry faster.

Studies have found that conditioning works, before and after rain, and in-and-of-itself to help dry the crop, and correct drying always helps to reduce the risk of mold development and aflatoxin.

Don't forget harvest and transportation equipment at the time of harvest. Growers and handlers need to clean and inspect their equipment prior to use and between the harvest of early and late varieties.

Stockpile Management

The growth of almond orchard acreage in the state has created the need for stockpiling of harvested almonds as growers face processing delays.

While stockpiling has its list of advantages, it has been shown, according to the Almond Board, that certain conditions during stockpiling can lead to concealed damage and *Aspergillus* mold growth that can lead to aflatoxin.

Continued on Page 16

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Continued from Page 14

Studies show stockpiling at a total fruit (kernels + hulls) moisture content greater than nine percent is problematic, according to Bruce Lampien, University of California (UC) Davis extension specialist in Plant Sciences.

This amount of moisture within the pile can result in a relative humidity greater than 65 percent, which is the maximum rH for almond storage, reports the Almond Board.

As per guidelines, do not stockpile if any one of the following moisture content/level conditions are present:

- The total fruit moisture content exceeds nine percent.
- The hull moisture content exceeds 12 percent
- The in-shell kernel moisture content exceeds six percent.

Crop moisture should be gauged while the crop is on the orchard floor, either before or after sweeping. Take a worst-case sample from the north side of the canopy adjacent to the trunk where moisture is typically two percent higher than in the crop in the drive rows and middles, advises the Almond Board. In the windrow, take sample nuts from the top and bottom.

If moisture is too high for stockpiling, the crop can be taken to a dry area where nuts may be turned and spread, or, machine



Almonds swept into windrows. Photo courtesy of Kathy Coatney.

drying may be necessary.

Place stockpiles on a firm surface, preferably one that is elevated to allow moisture to run off. In addition, stockpiles should be oriented in a north-south direction to aid in drying and covered with white-on-black tarps. Clear tarps can be used only for dry, in-hull product that is well below the moisture threshold.

Smooth the tops of the piles to help minimize the concentration of moisture from condensation that would occur in any lows spots.

If piles are stacked too wet, open up the tarps in the daytime when the relative humidity is lower, and close them at night when the relative humidity is high. These practices reduce humidity and day-to-night heat fluctuations, leading to a reduction in condensation.

Be sure to monitor and treat for insect, bird, and rodent pests. Stockpiles should be fumigated to reduce insect infestation. NOW is an excellent storage pest and can survive stockpile conditions, increasing damage as well as aflatoxin risk.

If rain threatens, ensure piles are covered.

Studies have shown that hull moisture above 14 percent and a holding temperature greater than 120°F will increase the risk for concealed damage, mold, and aflatoxin.

Finally, be aware that stockpiles are a potential fire hazard.

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Optimizing Your Orchard Spacing

By: Dani Lightle | UCCE Orchards Advisor, Glenn, Butte & Tehama Counties

Tree spacing in a new planting is one of the most important decisions you can make. Spacing will influence yield (both early and maximum potential), later pruning and hedging decisions, and possibly orchard longevity. Additionally, if you mess it up, you can't go back and fix it.

What you're trying to achieve:

The ideal spacing is one which maximizes your yield potential. Yield potential is directly related to the amount of sunlight intercepted by the trees. Notice, this is yield potential. Keep in mind that the yield can be limited by factors other than light, including water, nutrient availability, disease, insects, and weather. Over the last 10 years, Bruce Lampinen (almond & walnut Specialist, UC Davis), has thoroughly documented that photosynthetically active radiation (PAR)—the amount of sunlight able to be used for plant photosynthesis—is directly related to yields (*Figure 1, right*).

In walnuts, each one percent of PAR intercepted by the orchard canopy directly translates into 0.05 tons/ac in-shell (100 pounds/ac in-shell) of walnut yield potential. Thus, a PAR of 90 percent in an orchard with a mature canopy gives a yield potential of 4.5 tons/ac. 100 percent PAR is not achievable (highest recorded are around 93 percent) and denser canopies may lead to other problems with light penetration into the lower canopy or increased humidity and disease pressure.

Similarly, in almonds, each one percent of PAR intercepted translates to 50 lbs/ac of almond yield potential

in the best managed orchards. A PAR of 80 percent in a mature orchard gives a yield potential of 4,000 lbs/ac. In almonds, PAR above 80 percent has been linked with food safety concerns (Salmonella) because the nuts don't dry.

Consequently, orchard spacing should be selected to optimize canopy light interception while still facilitating orchard operations. A very wide spacing may prevent the canopy from completely filling in, while a very tight spacing may require repeated hedging from a younger age.

Factors to consider:

- **Soil type.**
 - The most productive orchards are planted on soils that are uniform, within salinity tolerances and with few barriers to drainage or root development. The best soils should be planted at a wider spacing than more marginal soils, which should be planted at a tighter spacing because soil limitations will lead to smaller trees, regardless of spacing.

Continued on Page 20

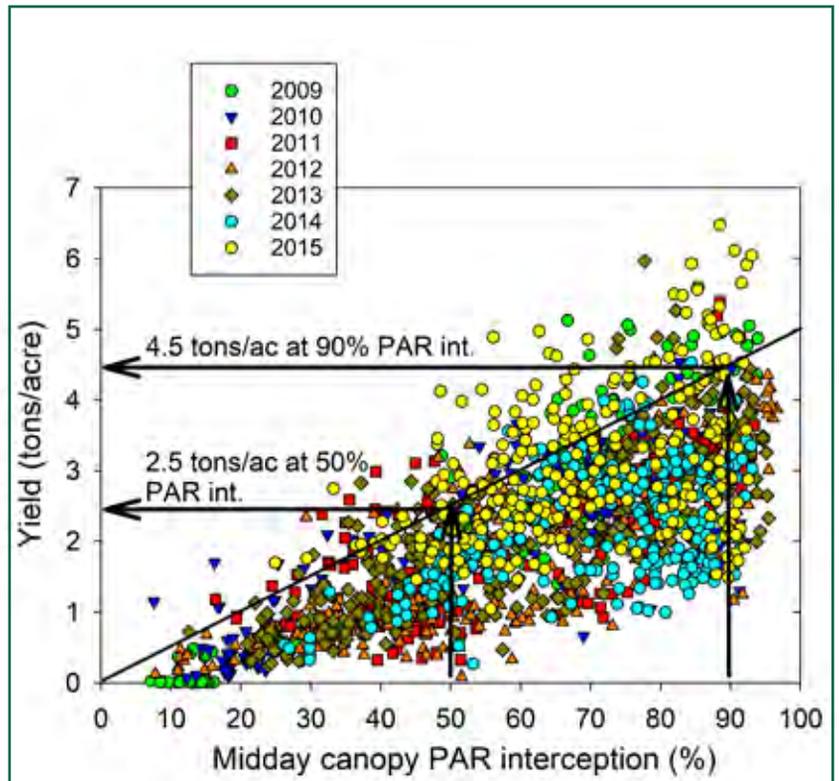


Figure 1. Relationship between PAR and walnut orchard yield. The best orchards produce along the (upper) solid black line.



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16 Years in Walnuts | 30 Years of Sorting in the Field

Continued from Page 19

- **Rootstock vigor.**

- *Walnuts:* Black rootstock is generally less vigorous than seedling or clonal Paradox rootstock and a closer spacing is recommended. The relative vigor of the clonal Paradox rootstocks Vlach, VX211, and RX1 varies by location and continue to be investigated. Information on clonal Paradox rootstock vigor can be viewed at www.sacvalleyorchards.com/walnuts/orchard-development/walnut-trees-in-the-nursery-trade/

- *Almonds:* Like walnuts, trees planted on vigorous rootstocks should be planted at wider spacings than those with lower vigor. Rootstock selection should take soil characteristics into account; for example, a vigorous rootstock on sandy soils may not perform as well on fine textured soils. Reach out to your local farm advisor for information on how various rootstocks perform under local conditions.

- **Variety (scion) selection.**

- *Walnuts:* Chandler and Tulare trees tend to be larger than Howard trees. If you're considering a hedgerow planting configuration, the smaller statured Howard is a better choice than Chandler.

- *Almonds:* Upright varieties such as 'Aldrich', 'Independence', or 'Padre' may do well at a tighter spacing, while spreading canopies like that of 'Monterey' or 'Nonpareil' run the risk of growing into each other or interfering with equipment operation at tighter spacing.

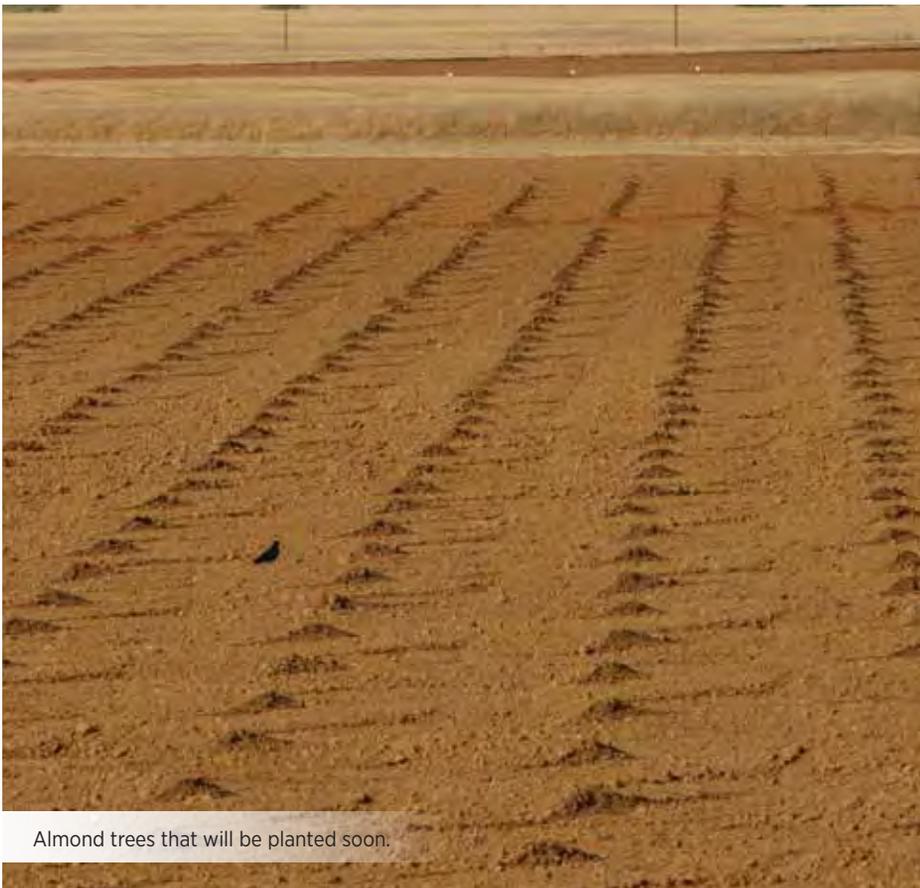
- **Site, equipment operation and expense.**

- It should go without saying that you need to stay within your planting area, provide clearance around easements, and allow equipment clearance in order to prevent injuries to field workers. Beyond that, wider row spacings require fewer passes per acre for herbicide, insecticide and fungicide applications or harvest operations. Establishment costs such as irrigation design—total length of irrigation line, risers and emitters—increase with a tighter row spacing.

- **Per tree costs.**

- Any activity performed on a per-tree basis—planting, wrapping, pruning, tying, painting, suckering, etc. will have higher costs with a greater number of trees per acre.

Continued on Page 22



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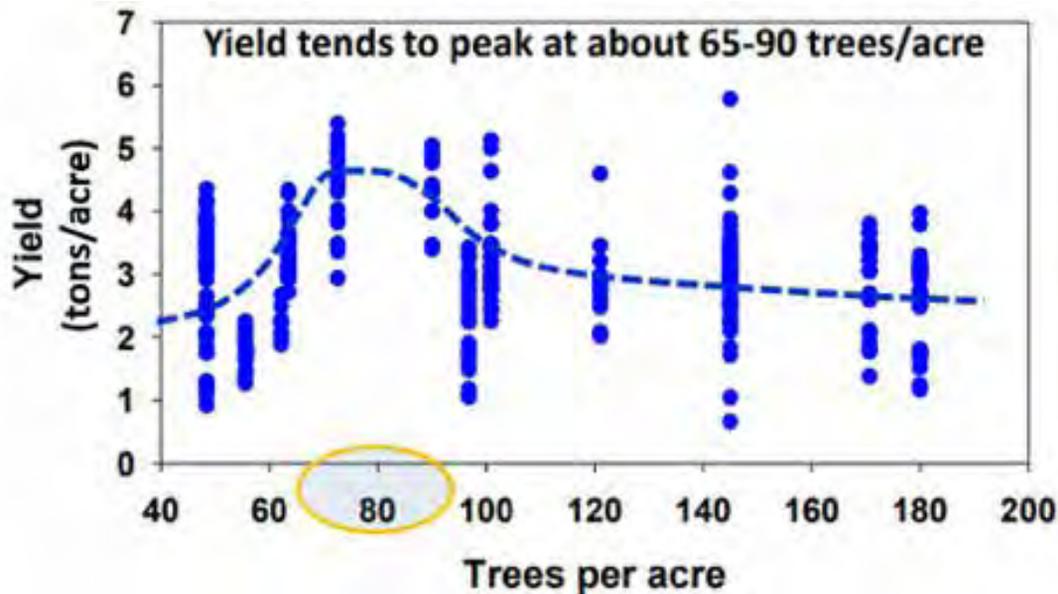


Figure 2. Relationship between number of walnut trees per acre and yield (tons/ac).

Continued from Page 20

- **Hedging.**
 - A tightly spaced orchard often relies on mechanical hedging to aid light penetration into the lower canopy, maintain a shorter canopy height for effective spray applications, or aid in efficient drying on the orchard floor (almonds). More rows per acre increases the number of passes the hedging crew needs to make. Additionally, the overall impact of hedging is often less in wider-spaced orchards since less wood and smaller diameter branches are being cut.
- **Disease risk.**
 - All pruning cuts are susceptible to infection by pathogens, such as *Botryosphaeria* canker in walnuts, however, the sheer number of indiscriminate cuts created by mechanical hedging can drastically increase disease likelihood and severely impact an orchards' productivity. A denser canopy may have greater humidity, which can exacerbate disease pressure.

Ideal Spacing: What's the Research Show?

For walnuts, PAR levels in a mature standard spaced orchard tend to range between 80-85 percent, giving a yield potential of approximately 4 tons/ac. In a hedgerow orchard, PAR generally ranges between 65-75 percent interception. Although this should result in a yield potential

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of 3.5 tons/ac, it is more commonly 3 to 3.2 tons/ac due to non-productive vegetative growth resulting from the hedging.

The highest yielding orchards ranged from 65-90 trees per acre, which corresponds to a spacing between 22 feet square and 26 feet square (*Figure 2, left*). That said, a 22 feet square planting is still quite tight for a standard spaced orchard given the conditions considered above, and we recommend wider plantings.

For almonds, row width typically ranges between 20 to 24 feet to allow equipment access. Down the row, research has indicated that tighter spacings (10-14 feet) have greater PAR interception than wider spacings (18-22 feet), and consequently, they out-yield wider spacings. There is such a thing as 'too-tight' in almonds: work with PAR interception in high density almond orchards (5 feet x 11 feet) has shown that their PAR tends to range around 44 percent which corresponds to a yield potential of 2200 lbs./ac.

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Row Spacing x Tree Spacing (ft)	# Trees/Ac
20 x 20	109
22 x 22	90
24 x 24	76
26 x 26	64
28 x 28	56
30 x 30	48

Table 1. Trees per acre at different row x tree spacings typical for walnut.



Row Spacing x Tree Spacing (ft)	# Trees/Ac
22 x 10	198
22 x 12	165
22 x 14	141
22 x 16	124
22 x 18	110
22 x 20	99

Table 2. Trees per acre at different row x tree spacings typical for almond.



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7:00 AM	Registration	
7:30 AM	Trade Show PCA-CE Credits: 15 minutes; Other	
8:00 AM	Top Four Things You Need to Know About Solar—Cost, Incentives, Availability, ROI. Panel TBA	
8:30 AM	NOW Management from Sanitation to Chemical Applications Jhalendra Rijal UCCE Farm Advisor/Joel Siegel, USDA CE Credits: 30 minutes; Other	
9:00 AM	<u>AREA 1</u>	<u>AREA 2</u>
	Panel Discussion—Commodity Boards Almond Board	Panel Discussion—Commodity Boards Jennifer Williams, CA Walnut Board
9:30 AM Break		
10:00 AM	Trade Show CE Credits: 15 minutes; Other	
10:30 AM	Update on Worker Protection Standards for Pesticide Handlers and Fieldworkers Marline Azevedo Deputy Ag Commissioner Stanislaus Ag Department CE Credits: 30 minutes; L&R	The Ins and Outs of Tree Nut Nutrition Richard Kreps, CCA
11:00 AM	Common Pesticide Use Violations & Compliance Solutions Marline Azevedo Deputy Ag Commissioner, Stanislaus Ag Department CE Credits: 30 minutes; L&R	What does the Future Hold for Ag Technology? Terry Brase, Interim Director Farm of the Future
11:30 AM	An IPM Approach to Soilborne Diseases from Management to Chemical Applications Phoebe Gordon UCCE Farm Advisor, Madera CE Credits: 30 minutes; Other	FSMA: What Every Handler and Grower Needs to Know Roger Isom WAPA/Jon Kimble Safe Food Alliance/Louise Ferguson UCCE Extension Specialist
12:00 PM Lunch in Lunch Area		
12:15 PM	NOW—Benefits of Mating Disruption - Area 1 Trécé Inc. CE Credits: 30 minutes; Other	
1:00 PM	Adjourn	

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All photos courtesy of Almond Board.

Last year, the Almond Board of California (ABC) marked the 10-year anniversary of its mandatory almond pasteurization program.

The almond industry is proud of the food safety record it's achieved and its unified efforts over the last decade. Looking back at the industry's initiatives and successes is a reminder of how crucial this work is and drives the exploration of what's next. ABC is committed to keeping the entire almond supply chain aware and prepared as new topics, control measures and quality assurance opportunities arise.

Understanding and Addressing the Risk

Outbreaks of Salmonella in 2001 and 2004 raised concerns regarding food safety and quality across low moisture food industries, including nuts. For California almonds, one of the biggest challenges was determining the true level of risk. The easy answer seemed to be that risk should be low; that, based on accepted conventions of the time, pathogens should not be able to grow in almonds and other low-moisture foods. However, the Almond Board investigated further and quickly realized that pathogens could in fact present a problem, so the organization decided to take action and tackle Salmonella, as well as other potential threats.

In collaboration with food safety experts and research partners, ABC began research in 2001 to better understand the prevalence and concentration of Salmonella contamination in almonds, conducted in tandem with efforts to develop strategies for contamination control. ABC was able to gather enough survey data over the course of several years to show that Salmonella was indeed present in about one percent of the almonds tested at very low concentrations. This data was fed into a risk assessment, which enabled identification of appropriate performance criteria for ensuring consumer safety (>4-log reduction).

Pasteurization —A Decade Later

A look back at California almonds' groundbreaking mandatory pasteurization program— and what's next in food quality and safety.

By: Tim Birmingham | Director, Quality Assurance & Industry Services, Almond Board of California

At the same time, ABC also worked to identify effective processing technologies and the best means of validating them. A Technical Expert Review Panel was assembled to help ABC develop a plan, assess research needs, establish standards and create guidelines for the industry. Extensive work went into determining how to validate equipment, including the determination of an appropriate surrogate (non-pathogenic microorganisms) that could be used in lieu of Salmonella in the plant. Concurrently, researchers worked to determine the specific time and temperature combinations needed for a >4-log (and 5-log) reduction for a range of pasteurization processes, including oil roasting, blanching and dry roasting, some steam processes and PPO (propylene oxide) processing. ABC and partners invested significant time and effort into this research, which culminated in the development of the groundbreaking mandatory pasteurization program for Salmonella reduction, and validation guidelines.

Process Implementation and Ongoing Education

Voluntary compliance with ABC's pasteurization program began in 2004, well in advance of September 2007, when it became mandatory. Today, the California almond Industry has more than 1 billion pounds of validated pasteurization capacity for processes that maintain the raw characteristics of almonds, including steam, moist heat and PPO. It also has close to 1 billion pounds of validated capacity for processes such as dry roasting, oil roasting and blanching. All reduce the level of potential contamination in almonds without diminishing the product's quality, nutritional value or sensory qualities (taste and crunch).

ABC also developed a comprehensive round of updates to recommended food safety practices, creating a powerful program with tools that help growers and processors achieve their desired results. These tools include Good Agricultural Practices, Good Manufacturing Practices, Hazard Analyses and Critical Control Point guidelines, and Pathogen

Environmental Monitoring resources.

The Almond Board has made a \$5 million investment in food quality and safety research and validated more than 200 treatment processes, to date. ABC remains committed to this mission, maintaining close connections with the scientific and regulatory communities to stay current on food safety in the broader context as well as issues specific to California almonds. All relevant in-

sights and information are disseminated to growers and processors in the form of clear, practical resources.

What's Next: Promising Biocontrol and FSMA Regulatory Progress

The mandatory pasteurization program is now well established—but not static.

Continued on Page 28

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ABC has made a \$5 million investment in food quality and safety research and validated more than 200 treatment processes, to date.

Continued from Page 27

ABC continues to stay on top of the latest food safety methods, regulations and needs impacting California almonds. For example, the annual Almond Food Quality and Safety Symposium is one event that keeps the almond industry at the forefront of food safety, quality leadership and innovation. This year's symposium was held on June 7 in Modesto and offered many exciting, essential updates on both the almond quality and regulatory fronts.

On the almond quality and safety side, aflatoxin levels continue to be a topic of interest, particularly for the European

Union market, which has one of the lowest tolerances for almond shipments. A new biocontrol product known as AF36 Prevail is now commercially available for orchard application with the benefit of displacing strains of mold which produce aflatoxin with those that don't. While AF36 shows promise, it is still essential to keep up with navel orangeworm (NOW) management, as NOW infestation still presents one of the greatest threats to aflatoxin development in almonds.

On the regulatory side, the Food Safety Modernization Act (FSMA) continues to roll out for growers and processors.

At this point, the almond industry and the larger community of food and beverage industries have had time to assess the impact on their stakeholders and take action to ensure FSMA compliance.

In addition, for the first time, growers and huller/shellers

falling under the farm definition may be audited by FDA (Food and Drug Administration) or FDA-designated agencies, under the Produce Safety Rule. Even if growers choose to utilize the commercial processing option, ABC encourages almond growers to understand the Produce Safety Rule's requirements and implement food safety practices appropriate to their farms.

Even with California almond's solid track record, the responsibility and work put in to maintain almond quality and safety is constant. ABC will continue to update and evolve its programs, not only as a function of compliance, but also to help growers and processors provide almond customers with a product of the highest quality.

Almond quality and safety information for growers and processors may be found at either Almonds.com/Growers, under the "Growing Safe Product" tab, or at Almonds.com/Processors, under the "Processing Safe Product" tab.

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SOIL DRAINAGE *for Your Pecan Orchard*

By: Cecilia Parsons | Associate Editor

Well-drained soil is crucial to optimum pecan production.

Dr. James Walworth, soil scientist and extension specialist at University of Arizona, said surveys of pecan orchards in that state show a definite trend related to soil quality. Pecan trees growing in lighter soils with good drainage tend to have higher yields than trees growing in heavier soils with poor drainage.

Soil conditions below the root zone can affect the long-term viability and production of an orchard. Research has shown that optimal pecan orchard sites have at least seven feet of depth above the water table to allow the root system to expand and not be in a saturated environment.

Orchards planted in poor draining soil will exhibit signs of stress due to lack of oxygen in the root zone.

Air, water, and nutrients must all be readily available to the tree's roots to foster growth. Roots compromised by poor drainage below the root zone will not have the ability to take up needed tree nutrients.

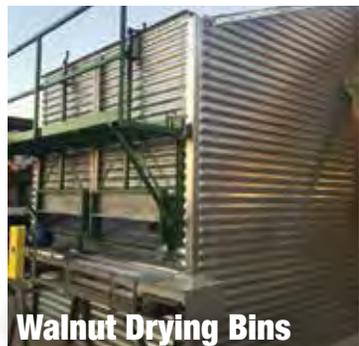
Drainage problems occur in soils that are shallow and have a caliche layer, clay soils with inadequate permeability, salt-affected soils and soils above high water tables. These conditions lead to water stress, salt stress, waterlogging and poor aeration.

Correcting these problems will improve root growth and increase a soil's water holding capacity.

Continued on Page 32

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Continued from Page 30

Pecan trees do tolerate wetter soil conditions during the dormant season or for short periods during the growing season, Walworth said, but roots in water or saturated soils for long periods during the growing season are detrimental to tree health.

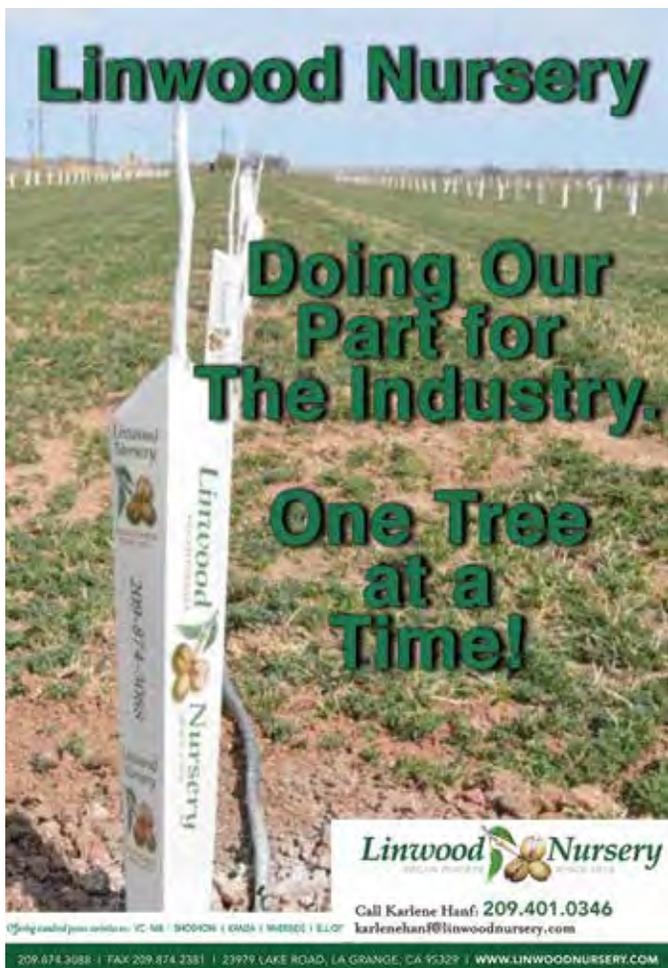
Soil Science 101

Soils are made up of sands, silt and clays; organic matter, air and water. The distribution, density and percentages of these soil components determine the soils physical properties including texture and structure.

Knowing the physical properties of the soil is the first step in developing a management plan. Identifying the soil type and profile will allow growers to make decisions on ground preparation, soil amendments and irrigation systems.

Soil structure of texture problems can be at the surface, but poor drainage in deeper soil layers also affect root growth. Those deeper soil issues include abrupt differences in soil profile, dense clay layers in the soil profile and impermeable layers or caliche that are barriers to water penetration. Layers can also become compacted due to orchard tillage when soil is wet.

Walworth said soils are composed of aggregates or chunks



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of soil that have varying amounts of air spaces between the soil particles. Pecan trees can be productive in clay soils, he noted, depending on their structure.

Accurate maps of soil types and characteristics in most growing areas are available from the Natural Resources Conservation Service. The soil maps contain information about soil texture, depth, presence of restricting layers within the soil profile and chemical limitations for specific areas. Walworth also recommended using a trencher or soil probe to evaluate an orchard site soil profile in all soil types found at the site if poor drainage is expected.

Overcoming Soil Issues

Chemical fixes can be done to improve the water infiltration in heavy soils. High sodium levels in soil breaks down aggregates, making it difficult for water penetration. A common solution to this problem, Walworth said, is an application of gypsum to improve permeability. Acids can also help by dissolving calcium layers, but this method works best at the surface and only in calcareous soils.

Repeat of these applications depends on the quality of the water used in irrigation. If it is high in sodium, repeat applications may be necessary. With higher quality water, repeat applications may not be necessary.

Physical limitations of the soil are harder to address, Walworth said. One of the prime pecan production areas, the Mesilla Valley of New Mexico has some soil challenges. Parts of the area have a layer of clay over sand. Growers are addressing this problem by using heavy equipment to mix the soils to a depth of two to three meters, Walworth said. Ideally, this process takes place prior to planting trees, but he said that growers in some cases have done the soil mixing between rows with good results. The mixing improves soil drainage. Upper layers may become compacted, but can be ripped to break them up.

A New Mexico State University

Cooperative Extension Service advised against using rippers to break up stratified soils because they will not mix the layers of varying soil textures and the layers will re-form in no more than two years after ripping.

Ripping is the method recommended to break up cemented hardpan layers in the soil profile. Breaking the layer is often all that is needed to ensure water drainage. A backhoe can be used to evaluate a site and assess soil issues. It can also determine the extent of the drainage problem within the profile or across the site. Trenches dug in different areas can reveal the extent of layers that would impede drainage.

Different Issues in Arizona

The sandier soils in Arizona pecan production areas pose a different problem for

Continued on Page 34



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Continued from Page 33

growers.

Very young orchards can experience soil erosion due to winds. Growers there, Walworth said, like to maintain a 'living floor' in their orchards. Mulches are applied to the orchard floor and cover crop vegetation roots keep the soil surface aerated.

The vegetation, which is mowed, provides a more settled base for harvests. One grower, Walworth said, used the weed nut sedge to provide a ground cover in the orchard.

New Mexico pecan growers take a different approach and prefer to have bare floors in their orchards, he said.

Along with a soil analysis, Walworth advised growers know both the quantity and quality of the water they will use for irrigation. The level of sodium is used in the classification of saline and alkali soils or to determine if a sodium hazard exists. This method

requires the determination of cation exchange capacity (CEC) and percent exchangeable sodium (ESP). A related measure, sodium adsorption ratio or SAR is used to evaluate sodium hazard in a water saturated soil extract. SAR is commonly determined on irrigation water to classify the sodium hazard.

The irrigation method should match soil types and conditions. A uniform supply of water can be delivered to each tree using a pressurized system. These systems can also help growers overcome infiltration issues because they can be operated to match the infiltration rate of the soil to the orchard's evapotranspiration rate.

In orchards not affected with drainage issues and under fairly level conditions, growers can choose a flood or furrow irrigation provided the orchard has a uniform slope.

with soil types and environmental conditions that are different from those found in New Mexico and Arizona. Keith Larrabee of Larrabee Farms in Chico has orchards planted in flood plain areas primarily on Class II soils. Those orchards tolerate prolonged flooding in the spring and the heavy soils can take longer to dry out. The trees are not sitting in a perched water table, he noted, but the water table can be higher in some orchards.

More water sensitive crops don't well in those situations, but he said his oldest orchard, in its 15th year, is productive.

"As the pecan industry in California continues to be established, they will be planted in a wider range of soils," Larrabee said.

California Conditions

California pecan growers are dealing

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A large, mature tree with a thick trunk and dense canopy of bright yellow autumn leaves dominates the left side of the image. The background shows a field of similar trees stretching into the distance under a clear blue sky. The ground is covered with fallen yellow leaves.

POST-HARVEST NUTRITION: *“Can’t we just wait until Spring?”*

By: Rich Kreps, CCA
Contributing Writer

We’ve been going over different aspects of post-harvest nutrition in the last couple articles. I’d like to tie it all together and drive home the nail that seals the importance of this period in plant physiology. In an attempt to avoid beating the proverbial ‘non-living’ horse, I’m hoping this last swing gets him moving. This is such a critical time in the cyclical events that make up farming that neglect can seriously hinder next year’s yields.

First and foremost, during this dramatic change in events that happen after harvest, tree crops need the spectrum of essential nutrients to reset themselves. Going from the fruit bearing stage to recovery is a very energy intensive process. That requires phosphorus. Phosphorus moves in a plant very well with the help of potassium. It attaches itself to chlorophyll molecules with magnesium. The energy we have spoken of before, (Adenosine triphosphate or ATP) is the byproduct of a derivative of carbohydrate, fat and protein oxidizing acetyl-coenzyme A. That also takes a pinch of sulfur as well. So, what in God’s green earth does that mean to me as a farmer?! In very simple terms, “There

Photo courtesy Kathy Coatney.



is a lot of stuff in that stew!” The good news is, many of those nutrients that drive enzyme and catalyst production are very dilute in their consumption. The bad news is, by October and November, worsening irrigation water, fertilizers (or in simple terms, salts), and the plethora of cocktails we have had to spray to keep our trees healthy have greatly diminished the roots ability to absorb some of these nutrients.

Let’s move to timing. After running that marathon for 7-8 months, we have 3 months to recover. Think about those Grizzly bears eating their weight several times over on the fall salmon runs to store fat for winter. Our trees do the same thing, but in the form of carbohydrates. How do we make carbohydrates? Photosynthesis. Driving this is a massive root flush in our trees right after we shake our crops. Those root hairs are foraging for nutrition to enhance photosynthesis and gain mass for carbohydrate storage. Building structure in those root hairs requires a lot of calcium. If our irrigation water is loaded with carbonates, bicarbonates and at high pH that calcium gets tied up. Applying big loads of phosphorus in forms that aren’t plant ready will tie up more of our available calcium. Which in turn will make the phosphorus that has been applied even more insoluble! Sounds like a vicious cycle doesn’t it? That’s exactly what it is.

So, we’ve beat a dead horse, fed Grizzly bears, given our trees cocktails, and you’re scratching your head thinking I just said, “It won’t work. Well, not ex-

actly, but it can work better. My growers that make the biggest yields year after year don’t neglect their post-harvest nutrition. They also don’t just throw on big slugs of it and call it good. We take a systematic approach to nutrition and hit it from all sides. I equate those large slugs of less soluble or non-plant ready nutrition to a human analogy. If you’re hungry now, would you rather have a nice, 12 oz. medium rare rib-eye or a frozen side of beef?! You’d devour the ribeye, but the frozen side of beef would have to be thawed, cut, cooked and hopefully you’d get to it all in the next month or two before it was ruined.

As soon as those nuts are off and the pumps go back on, think about fertigating a few gallons of a soluble calcium source mixed with some organic acids. This will hopefully open your ground back up a bit and release some of that dreaded sodium below the root zone. The organic acids will help chelate some of the nutrition that was previously applied and hold it in the soil solution. That thick black mass of carbon will also help the soil biology as it flourishes again and mines more of the stored nutrients. As soon as you can get back in your fields with your spray rigs, go upstairs with focused micronutrient blends of the nutrients you were deficient in this year. This will accomplish 3 things. (1) The water applied will clean off those solar panels we call leaves. (2) Hungry plants will still be able to assimilate nutrition through the leaves especially while it’s still warm. (3) Studies

Continued on Page 38

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have shown that micronutrients applied foliarly can be assimilated in amounts as high as 7-1 over amounts applied to a buffering soil. Please don't neglect magnesium if you were deficient on your in-season tissues. Photosynthesis will be at a premium now and magnesium is the key element in a chlorophyll molecule.

In the next irrigation, apply a soluble, plant ready orthophosphate solution in with your potassium and nitrogen. The smaller amounts of soluble calcium should already be taken up by the roots. As the soluble plant ready form of P washes over the roots in solution a good amount should be taken up in this next wave. Phosphorus is typically 10 percent of your nitrogen percentage in tissues if you are adequate. It doesn't take much but it has to be absorbable. Smaller, fertigated shots of P will leave less in the soil than bigger slugs that

may not be assimilated. Those organic acids still in your root zone will help keep any additional calcium and phosphorus apart. Get some plant ready nutrition into them first and then deal with trying to move the needle in your soil. It's much easier to first get assimilation into a tree through the roots and foliarly than trying to increase ppm (parts per million) on millions of pounds of soil per acre. Additional, less soluble calcium, sulfur and potassium soil amendment blends can be applied later to soils that are severely deficient. If you can't incorporate them into the soil, let mother nature take them in later with cleaner water as rainfall. This would also be a great time to add some organic matter and biology in the form of compost, manure or planting your winter cover crops. A good post-harvest program may seem a bit expensive, but an increase in production and orchard health can greatly increase that return

on investment! Making sure you don't put those trees to bed hungry will greatly enhance their ability to produce higher yields next year.

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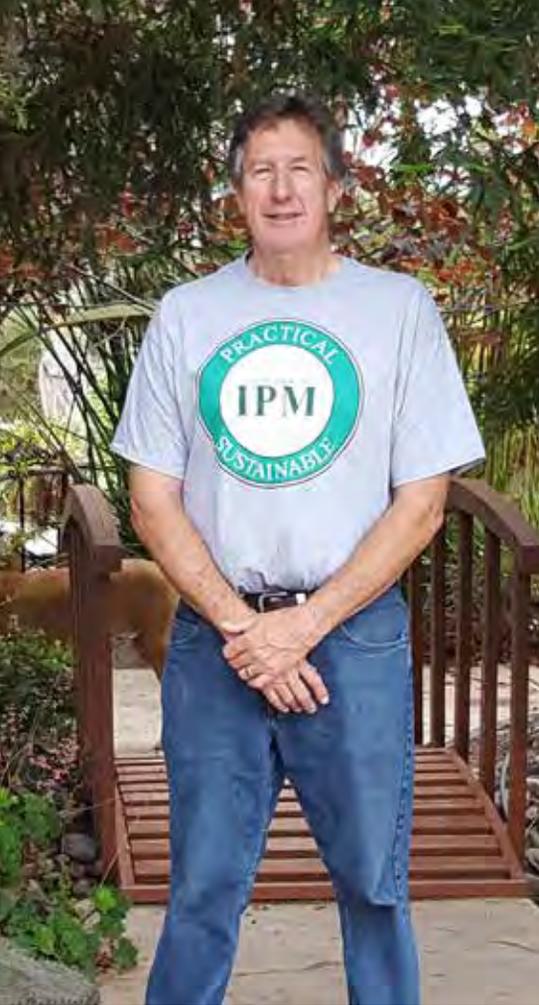
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Can We Develop an IPM-based Food Production System *to Ensure Safety, Sustainability, and Security of our Food?*



By: Surendra K. Dara

Santa Maria strawberry grower, Dave Peck, Manzanita Berry Farms. All photos courtesy of Surendra Dara.



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Different people have defined sustainable agriculture or food production in different ways. In general, sustainable food production refers to the farming systems that maintain productivity indefinitely through ecologically balanced, environmentally safe, socially acceptable, and economically viable practices. It is a system that ensures food security for the growing population of the world by taking science, economics, human and environmental health, and social aspects into consideration.

Evolution of Agriculture

Agriculture has evolved over thousands of years from subsistence farming, meeting the needs of individual families, to agribusiness, catering to the needs of consumers around the world. Arthropod pests, diseases, and weeds (hereafter referred to as pests) have been an issue all along, but their management went through cyclical changes. In the modern ages, pest management initially started by using naturally available materials such as sulfur or plant-based pyrethrums that gradually evolved into using toxic pesticides of natural or synthetic origin. While pesticide use improved farm productivity and food affordability, indiscriminate use of synthetic broad-spectrum pesticides in mid 1900s led to serious environmental and human health issues. Pesticide use regulations, discovery of safer pesticides, and new non-chemical alternatives, in the past few decades, have improved pest management practices to some extent. However, large quantities of synthetic chemical pesticides are still used in conventional farms for managing a variety of pests to pre-

vent yield losses and optimize returns. Lack of good agricultural practices or IPM awareness has also contributed to excessive use of chemicals and the associated risk of resistance in pests and environmental contamination. In some developing countries, or countries where pesticide use is not strictly regulated, highly toxic pesticides are used very close to the harvest date (or even after harvesting), causing serious health risks for consumers.

Under these circumstances, in recent years, consumer preference for chemical-free food gave impetus to organic production; thus, the acreage of organically produced fruits, vegetables, and nuts has been gradually increasing. Many stores now promote and sell fresh or processed organic foods, at premium prices, to those who can afford them. While organic farming is generally considered more challenging and less productive, growers are willing to take the risk as they try to meet the market demand and maintain their market share of organically grown produce. However, managing weeds in organic farms continues to be a labor-intensive and expensive part of production. Labor shortage in many areas exacerbates manual weed control. In some crop and pest situations, control of pests with organically acceptable tools is not sufficient. Unmanaged pest populations can spread to other areas and/or crops, cause higher yield losses, and indirectly contribute to higher pesticide use on neighboring conventional farms.

IPM Approach

On the other hand, an integrated pest management (IPM) offers an effective, practical, and sustainable solution where excessive use of chemical pesticides is limited, pest populations are effectively managed, and returns are optimized without having a negative impact on the environment. IPM is an approach where host plant resistance (selection of resistant cultivars), modification of planting dates, crop density, irrigation and nutrient management or use of trap crops (cultural control), conservation or augmentation of natural enemies (biological con-

trol), pheromones for mating disruption or to attract and kill (behavioral control), traps, netting, and vacuums (mechanical control), chemicals from various mode of action groups (chemical control), plant extracts (botanical control), and entomopathogens or their derivatives (microbial control) are used in a balanced manner. It is a comprehensive approach where all available strategies are considered to achieve pest control with minimal impact on the ecosystem. However, many consumers are not aware of the difference between organic and conventional practices or IPM strategies. Many perceive organic farming as a pesticide-free production system and as the only alternative to conventional farming with synthetic chemicals and nutrients. Organic farming also uses pesticides, fertilizers, and hormones, but of natural origin. For example, potassium salts of fatty acids are used against insects, mites, and fungal diseases. Mined sulfur is used as a miticide and fungicide. Popular organic insecticides, based on pyre-



Sanjay Kumar Rajpoot at the Santa Maria Strawberry Field Day in 2016.

Continued on Page 42

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Continued from Page 41

thrins extracted from *Chrysanthemum cinerariaefolium* flowers, are very toxic to natural enemies, honey bees, and fish although they are less stable in the environment than synthetic pyrethroids. The bacterium, *Bacillus thuringiensis*, which is the source of the toxic insecticidal protein in genetically modified corn, cotton, soybean, and other crops, is widely used in organic farming for managing lepidopteran pests. Organic produce is also perceived to be healthier than conventional produce although several studies showed that there was no such difference. A thorough understanding of conventional, organic, and IPM-based production could influence consumers' preference and allows them to make informed, practical, and science-based decisions. Conventional farming, in this context, refers to a system where it is more geared towards the use of synthetic compounds with a lesser emphasis on natural or biological approaches.

IPM has Advantages

IPM encourages the use of all available control options in a manner that maintains productivity without compromising environmental and human safety. IPM-based food production can be a better alternative than organic production for various reasons (*Table 1, below*).

Since pest control efficacy, productivity, and operational costs are optimized for affordable food production without compromising health aspects, an IPM-based food production system, which utilizes both modern and traditional technologies, might offer a better alternative to the organic system. IPM-based production allows the use of chemical pesticides to address critical pest issues when needed, without losing the focus on environmental safety and sustainability. Agriculture is a global enterprise and California agriculture leads and influences farming practices around the

world. While food production with an organic seal can continue, shifting from conventional practices to production with an IPM seal might be a practical and sustainable approach.

Additional reading:

- Dara, S. K. 2015. Producing with the seal of IPM is a practical and sustainable strategy for agriculture. UCANR eJournal Strawberries and Vegetables. <http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=19735>
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Table 1. Comparison of various food production systems from the global perspective.

	CONVENTIONAL	IPM-BASED	ORGANIC
Approach	Both synthetic and natural fertilizers, pesticides, and other inputs are used. Although biological, cultural, and other non-chemical options and natural sources of nutrients are also used, the focus is generally on synthetic compounds	Conscious effort on using cultural, biological, and other options first and using chemicals as needed. A balance in using synthetic and natural compounds	Emphasis on sustainability and using natural materials. Prohibits the use of synthetic fertilizers and pesticides
Production Cost	Low mainly because several chemical pesticides and synthetic fertilizers are inexpensive	Optimized because a variety of practices and are implemented and materials used	Generally high due to higher cost of control options and limited nutrient sources
Returns	Higher in the short term	Higher in the short term	Moderate
Pest Control Efficacy	Generally higher unless there are resistance issues due to indiscriminate pesticide use	Generally higher by taking advantage of multiple control options and yields are also higher	Low to moderate depending on the pest
Pesticide Resistance	Higher risk due to repeated use of certain chemicals	Lower risk due to optimal use by rotating chemicals in different mode of action groups or by rotating with non-chemical alternatives	Repeated use of certain biopesticides or organic-approved pesticides can still lead to resistance
Endemic & Invasive Pests	Critical for managing certain pests	Important for managing all pests	Some pests can be very difficult to manage and spread to other areas
Natural Enemies	Can have a negative impact on natural enemies	Minimal to moderately negative impact on natural enemies	Minimal to moderately negative impact on natural enemies
Environment	Environmental health can be affected when certain chemicals are used	Environmentally safe	Environmentally safe
Human Health	Human health is typically not affected where pesticide use is effectively regulated	Safe for human health	Safe for human health
Food Security	Ensures food security and is affordable for all consumers	Ensures food security and is affordable for most, if not all, consumers	Food security is difficult and affordable for only some consumers

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DOUBLE DENSITY Hazelnut Production Makes Sense for Oregon Growers

By: Cecilia Parsons | Associate Editor

Photo courtesy of Nancy Birkemeier.

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In an effort to double down on hazelnut production, Oregon growers have turned to double density orchard systems.

Double or High Density Plantings

Nik Wiman, orchard specialist at the North Willamette Research and Extension Center, estimates that 80-90 percent of Oregon hazelnut orchards planted in recent years are in the double or high density configuration, a practice that began in the 1970s. The reasoning behind the move to more trees per acre, Wiman said, was that yield in a double or high density orchard is roughly twice the yield from a standard density orchard for the first five to six years of production. Yield per acre goes up in proportion to the increase in the number of trees per acre.

“It’s become very popular in hazelnut production due to those higher early yields,” Wiman said.

Spacing

Standard hazelnut tree spacing is 20 feet by 20 feet with 108 trees per acre. A slightly tighter spacing of 18 by 18 feet can also work, but rows are typically closer than 16.5 feet to accommodate harvest equipment; The advantage of wider tree spacing is that it allows plenty of sunlight for growth and production even at maturity. The disadvantage, compared to closer spacing is lower crop yield in the early years.

A high or double density pattern is generally 10 by 20 feet or 9 by 18 feet with 218 trees per acre. There are variations in distance between trees and between rows. In the early years there is adequate sunlight for tree growth and crop production.

Hazelnut Acreage

Hazelnut acreage in Oregon is at 67,000 acres most of them in the Willamette Valley where soil and climate conditions are favorable for hazelnut production. According to the hazelnut industry, more than 3,000 acres are being planted to hazelnuts each year. Prices paid to hazelnut growers have fallen in recent years with the minimum price for 2017 at 96.5 cents per pound. The 2016 starting price was \$1.18 per pound, down from the 2014 price of \$1.70.

Oregon produces nearly all U.S. hazelnuts, but only three to four percent of the world's supply.

Disadvantages to Double Density

Hazelnut trees can yield a small crop by their third year, and up until their 12th

year the advantage of double density is clear. Twice the number of trees yields twice the crop size. It's when trees begin to compete that the disadvantages of the closer tree spacing become apparent. In the past, the assumption was that temporary tree removal would be necessary between the ninth and tenth year, but with a push for more rapid growth, the removal date can arrive much sooner.

"Once the trees are competing for sunlight, nutrition and water, delaying removal can have permanent consequences," Wiman said.

Hazelnut nurseryman and grower, Rich Birkemeier of Canby said the high density orchard planting works well for some growers, but it can be a mistake for others. There are some who will have a difficult time removing perfectly healthy trees after ten years of tending to them.

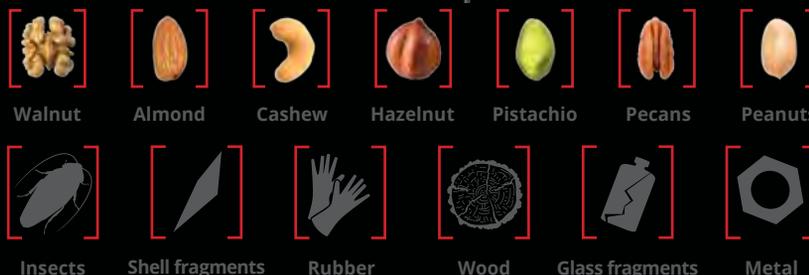
"They look at the cost of removal, but forget the extra money they have made with the extra trees," Birkemeier said.

One of the variations of a high density

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planting is to plant two different varieties of hazelnuts and evaluate their production and, when it is time to remove the extra trees, decide which variety is working the best. Another option is to leave half of each. Either way, Birkemeier said, the orchard will have double the cross-compatible pollen.

Standard plantings are still a good choice, Birkemeier said. If the trees are

in an optimal environment they can be pushed a little for faster growth. Pushing trees in a high density orchard can lead to higher vegetative growth, he added.

Wiman said he has seen high density hazelnut orchards in their seventh year needing tree removal, but most orchardists will wait longer before removing trees. He said some growers anticipate the overly close tree growth and cut back on the canopies of the trees that

will be removed to allow the permanent trees more sunlight. Consequences of leaving the temporary trees in a high density orchard are tall, unmanageable trees that can hinder cultural practices including pest control, Wiman said. Leaving the temporary trees in the ground for longer periods also increase the chances that the root systems have become entangled and then removal shocks the permanent tree.

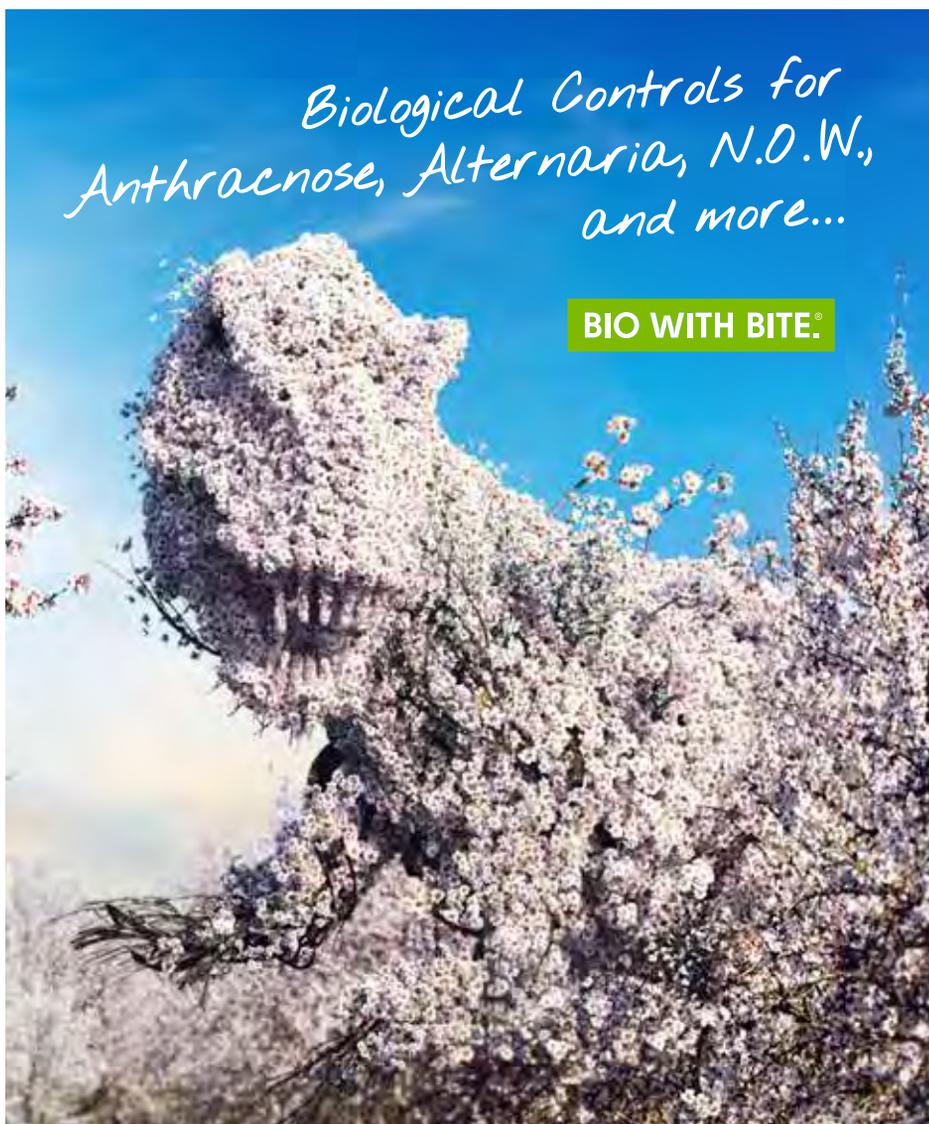
Growers who chose the closer tree spacing strategy lose the ability to cross flail their orchards, but if they have drip irrigation systems, that choice is already lost. There are higher costs for tree purchases and the eventual cost of tree removal at thinning time. Wiman said the high density orchards would need more intensive management to reach their yield potential. There is twice the work in high density orchards with removing suckers and mulching trees.

Poorer Soils

Wiman said some hazelnut growers feel that planting high density orchards in poorer soils may not require the temporary tree removal after ten years because the trees will not achieve the same level of growth as they would with better soil conditions. With the recent growth in hazelnut popularity, more orchards are being planted farther south in the Willamette Valley where clay soils predominate.

It has been common practice to plant a crop like grass seed in young hazelnut orchards and continue to harvest while the trees are young, Wiman said. It can be complicated to manage both crops as crop protection material registrations must be registered on both crops. In the absence of an inter planted crop, the orchard floors are often kept bare and smooth in anticipation of harvest. Orchards planted on hilly ground would do better with a soil-holding cover crop planted to prevent soil erosion. A grass crop can also help if harvesting equipment needs to be moved through the orchard after a rain event.

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THE BEST TECHNIQUES for Orchard Floor Management

By: Cecilia Parsons | Associate Editor

Orchard floors are managed to facilitate irrigation, cultural practices, tree nutrition and harvest. While these tasks are common in almost all tree nut orchards, it is important to note that soil and environmental factors can vary widely from orchard to orchard and limit effectiveness of the management inputs.

The planning for the orchard floor design and maintenance after trees are planted needs to be site specific, said Nate Laux, crop consultant with Integral Ag of Chico, California.

Cookie Cutter Approach

The ‘cookie cutter’ approach or doing what works for your neighbor is not the best orchard design option, Laux said. The list of factors to consider when planning an orchard floor includes commodity type, soil type, salinity levels, and the irrigation system that will be used. Leaving ample space for harvest and spray equipment is also a must.

Laux, who is also a tree nut grower in Tulare County, emphasized that floor design practicality and adjusting plans to address conditions at the orchard site will make floor management much easier down the road.

“You have to look at the pros and cons for each type of floor. Do you want berms? Should they slope? How wide should they be? Or will a flat floor be more advantageous?” Laux asked. “What works for your neighbor might not necessarily work in your orchard.”

An example of a bad choice in floor design would be almonds on berms in sandy soils. While the berms may help with soil temperatures in certain conditions, the soil is going to dry out quicker and irrigation management will be difficult. Once trees are in production, Laux warned that tree stress

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Andrew Kisling of Kisling Farms in Terra Bella has a formula for achieving the hard, smooth floors in almond orchards that make for a cleaner harvest. All photos courtesy of Cecilia Parsons.

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Continued from Page 48

and stick tight nuts can result from limited water holding capacity of sandy soils when trees are planted on berms.

Before Breaking Ground

Floor design needs to be done before breaking ground, Laux said. In well drained soil areas, berms are not necessary, especially in southern almond growing areas. In the north, in cooler areas, they can help by fostering warmer soil conditions allowing earlier tree growth in the spring.

Berms can be a benefit in other orchard conditions. In areas with perched water tables, Pistachio tree roots can sit above the water with the help of berms. There may be issues with harvesting equipment space, however. Hard, solid floors or smaller berms may be the answer.

Berms are not always needed in pistachios orchards, but they can help in heavy soil areas or where orchards are prone to flooding by keeping the tree roots above water.

Weeds and rodent mounds can make additional floor maintenance necessary. In flat orchards, the ground can be cross-floated to achieve a level top. With berms that is not possible and rodent holes can be an ongoing issue.

In some instances, Laux said, it is best to stop working the

ground and let winter rains settle the tops. Over time, unless they are driven over when wet, they will become hard and smoother.

NOW

Orchard floor design and maintenance, up until five or six years ago was mainly grower preference or integrated with an irrigation system. Today, a big consideration in almonds and pistachios is navel orangeworm (NOW) control. Orchards with floors that hide and harbor nuts left behind after harvest, or make clean sweeps difficult are prone to higher NOW pressure.

In pistachio orchards in particular, there is a push to re-consider how orchard floors are designed. Solid floors where nuts can be easily seen, swept and flailed or removed are preferred.

“When they are flat, you can see what’s going on with your sanitation,” Laux said.

Optimal conditions for NOW control in an orchard, Laux said, is to have a smooth, flat surface. Ruts and cracks in the soil or low areas where nuts can sit and become hosts for NOW are obstacles to a control program. When trees are on berms, Laux said, the berm blower may not be able to get in close enough to be effective and blow nuts off berms so they can be flailed or swept. It also pays, Laux noted, to walk the orchards after the berm blowing operation to see how effective it was.

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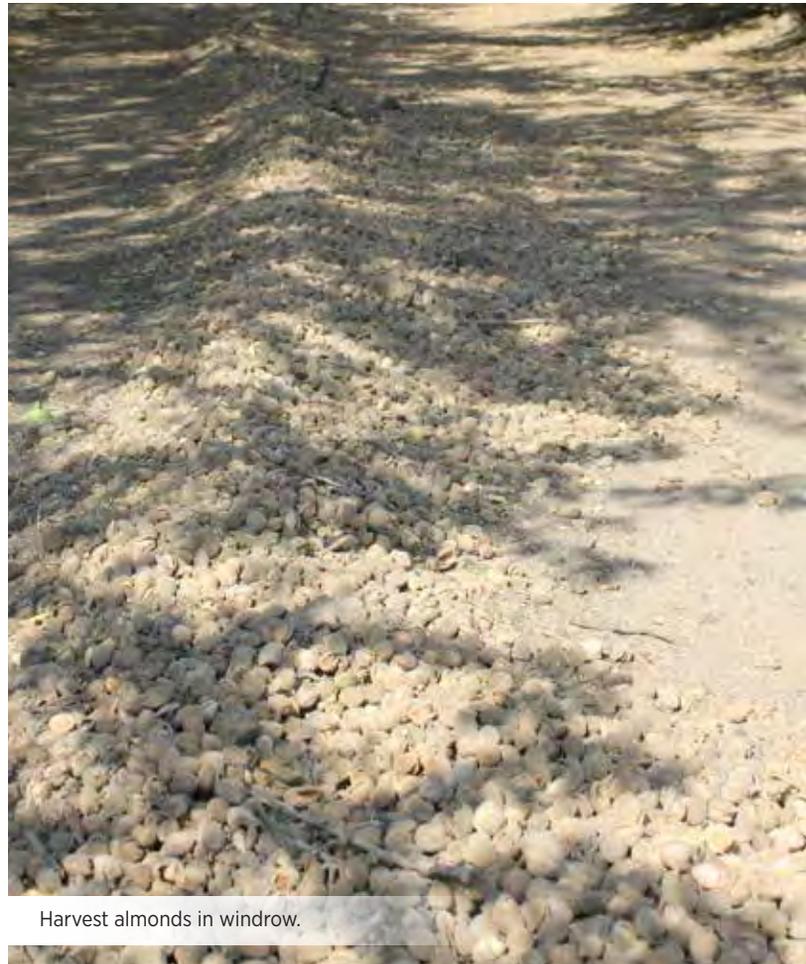
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Harvest almonds in windrow.



Andrew Kisling of Kisling Farms in Terra Bella, looking over Fritz almonds scheduled for a mid-September shake. Green weeds that sprouted after the nonpareil shake and harvest earlier will be burned down with herbicide to reduce moisture in the orchard and help these nuts dry faster.

At harvest, a smooth, hard floor provides optimal conditions for clean pickup of almonds and walnuts. This scenario is less important in pistachio harvest, but it does help in moving harvest equipment through the orchard.

How One Grower Maintains Floors

Management of orchard floors is a year-round commitment at Kisling Farms in Terra Bella. Kisling Farms is operated by Andrew and Lukas Kisling and their father, Steve Kisling. They own and manage almond orchards in southern San Joaquin Valley.

Keeping the orchard floors level, smooth and hard not only facilitates harvest for Kisling Farms, it allows for easier orchard access, causes less dust and fewer dust related pest issues, and leads to a cleaner harvest. Farming almonds on sandy or lighter soils means paying attention to details.

“Never disk,” Andrew Kisling emphasizes. Once the trees are in the ground, the time for disking to control weeds is over. “You don’t want to disturb the middles.”

The ground can be smoothed, borders added and an orchard mulcher can be used to break up large dirt clods, but disking middles, even for weed control, makes more problems that it solves, he said. If there are water penetration issues, come in with a shank and rip at the tree drip line, then blade smooth.

Continued on Page 52

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Post-harvest

Following almond harvest, Porterville area almond grower Kisling said work begins to make sure the orchard floors will be prepared for next year's harvest. Returning the floors to the pre-harvest shape is done by x-blading while the ground is dry. This tool returns dirt that was swept to the sides during harvest back to the row middles.

After an irrigation, attention turns to weed control on the berms. Kisling said they will apply Goal for it's residual action in early November, but leave weeds in the middles as they can help with orchard access after early rains.

In January, they apply another round of tank mix herbicide with residual action, applying it in the middles, five and a half feet from the tree row on each side. The herbicides are rotated based on mode of action to avoid resistance. Their worst weed problems, Kisling said, are fleabane and water grasses. With the weeds burned down, the next orchard chore is mowing to destroy mummy nuts on the ground.

By bloom time in February, mowing is essential in keeping weeds under control and to ensure soil heat is retained in

case of a freeze event. Herbicides are used to burn down any escaped weeds.

From June to harvest time, 100 percent of the orchard floor is burned down with Paraquat to ensure it is clean when trees are shaken.

For the later harvested varieties, Kisling said they may have to control any new weed growth as the moisture it collects can affect nut drying.

Outside of orchard maintenance, water discharge regulations make it important to consider erosion control and water quality protection.

University of California soil resource specialist Toby O'Geen said orchard soils must be protected from water droplet impact for erosion control. Mulches or ground covers can be used to soften impacts. Soil amendments or changes in tillage are two means of erosion prevention. Good water infiltration helps with runoff, but runoff pathways, if found, need to be intercepted.

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8:00 AM	Panel Discussion—Have Questions on Almond, Walnut, Pistachio Varieties?—Get Them Answered Here Panel Speakers—Cliff Beumel, Sierra Gold Nursery, Walnuts; Craig Kallsen, UCCE Farm Advisor, Pistachios; Mel Machado, Blue Diamond, Almonds; CCA Credits		
8:30 AM	Panel Discussion—Recent Advances in NOW Management Bob Klein, Manager, California Pistachio Research Board; David Haviland, Entomology and Pest Management Farm Advisor, UC Davis CE Credits: 30 minutes; Other		
9:00 AM Break			
9:30 AM	Trade Show CE Credits: 15 minutes; Other		
	<u>BUILDING 1</u>	<u>BUILDING 2</u>	<u>BUILDING 3</u>
10:00 AM	Pistachio Commodity Boards Richard Matoian, Executive Director, Pistachio Board	Almond Commodity Boards Spencer Cooper, Senior Manager, Field Outreach and Engagement, Almond Board of California	Walnut Commodity Boards Jennifer Williams, Claire Lee, Carl Eidsath, California Walnut Board
10:30 AM	Best Practices for Orchard Floor Management to Improve Harvest and Avoid Water Runoff Nate Laux, PCA, Integral Ag Inc. CCA Credits	5 Steps to Controlling Spray Drift Tulare Agriculture Department Marianna Gentert, Deputy Agricultural Commissioner CE Credits: 30 minutes; L&R	Soil/Water Considerations and Sampling for New Orchards Blake Sanden, UCCE Farm Advisor CCA Credits
11:00 AM	Panel Discussion—Managing and Controlling Canker Diseases in Almonds and Walnuts Mohammad Yaghmour, UCCE Farm Advisor; Florent Trouillas, Assistant Specialist at UCCE Kearney CCA Credits	Best Control Options for Bot Diseases in Nut Crops Themis Michallides, Professor and Plant Pathologist, UC Davis CE Credits: 30 minutes; Other	Dynamics of Vegetative Growth and Spurs of Almond Elizabeth Fitchner, UCCE Farm Advisor CCA Credits
11:30 AM	Fall Irrigation and Dormant Season Salinity Management in Nut Crops Mae Culumber, UCCE Farm Advisor CCA Credits	The Things you Need to Know When Spraying Near Schools and Sensitive Areas Tulare Agriculture Department Marianna Gentert, Deputy Agricultural Commissioner CE Credits: 30 minutes; L&R	FSMA: What Every Handler and Grower Needs to Know Roger Isom, WAPA; Jon Kimble, Safe Food Alliance; Louise Ferguson, UCCE Extension Specialist CCA Credits
12:00 PM Lunch in NEW Lunch Area			
12:15 PM	NOW—Benefits of Mating Disruption - Building 2 Trécé Inc.; CE Credits: 30 minutes; Other		
1:00 PM	Adjourn	Regulatory Update Tulare Agriculture Department Marianna Gentert, Deputy Agricultural Commissioner CE Credits: 30 minutes; L&R	Adjourn
1:30 PM	Adjourn		

THE COLLATERAL DAMAGE of *Tariff*\$

By: Jenny Holtermann | Contributing Writer

Farmers are Busy

Farmers are the only ones who pay for everything at retail and sell everything at wholesale. It is a sad but true fact. Chemicals, seed, trees, fertilizers, gasoline, diesel, equipment, everything we buy we pay at retail cost. When it comes time to sell our crops, we are lucky to walk away with half of that \$5 a pound you see almonds selling for at the grocery store.

Unless you are a large corporation who grows, packages, markets and sells your own product you don't have much of a say for where your product is going and what price you will be receiving. Almonds have to be hulled, shelled, processed and pasteurized before they reach the consumer. All we do is grow it. All those other inputs and stages along the way take their cut and portion as well. At the end of the day, farmers are price takers. Everyone else is the price setter.

Trade and Tariffs

Trade is a whole other beast. Where your product goes, when it sells, when it ships, what form it is sold in, and finally who is going to buy it, these are all factors that generally the farmer does not handle. Don't get me wrong, as farmers, we are plenty busy growing the crop much less have time to do all the rest. It takes enough time and patience to grow a crop. Most farmers do not have time to watch markets, handle packaging, monitor shipments, arrange transportation and everything else that goes into it. Processors, brokers and traders are the ones who closely watch trade and make the deals to ensure farmers get the best return possible.

Then there are tariffs. Tariffs are essentially taxes on goods being imported and exported into foreign countries. Like it or not, countries implement tariffs. Tariffs have been placed on nuts for years. It is something we knew, dealt with and handled. That was until, January 2018, when President Trump placed a 30 percent and 20 percent tariff respectfully on solar panels and washing machines coming into America



Harvested almonds. All photos courtesy of Jenny Holtermann.

from China. China is the world's leader in solar panels and washing machine manufacturing and Trump is all about promoting and protecting local manufacturing in America. China did not like this. I understand the idea behind the tariffs, but unfortunately, farmers have become collateral damage.

China already had existing tariffs on agriculture products prior to this tariff war, almonds for example were already at 10 percent. On April 2nd, China placed an additional 15 percent retaliatory tariff on agriculture products due to the US tariffs being placed on steel and aluminum. On June 15th, it was announced there would be another 25 percent tariff going into place July 6th. For nuts this brought pistachios up to 45 percent, almonds to 50 percent and walnuts to 65 percent tariff. This means agriculture products now cost more for the same product the Chinese consumer would have purchased months ago.

Final Breaking Point

The real question here is, what is the final breaking point for the consumer? At what point will the Chinese consumer stop buying California agriculture goods because of the increased tariff? I think this is the question that has farmers worried. Commodity boards, processors and marketers have spent more than 20 years building relationships and establishing markets in places like China. According to the Almond Board of California, China is the 3rd largest export market for California almonds. Last year alone, we exported more than \$500 million of almond shipments into China. Farmers have invested in these markets by planting more acres, processors have invested in packaging, marketers have invested in time building those relationships and sales. Tree crops are an investment. We plant a tree, wait three plus years for a crop and hope we get a decent crop for 20-25 years before we need to replant. That timeframe is even larger for walnuts and pistachios, making a longer wait for return on investment. Is it possible now that all that investment and time could be wasted?

Competitors

Australia is a leading competitor to the California almond industry for places like China. To make matters worse for California, Australia and China recently entered into a free trade agreement to eliminate almond tariffs by 2019. Would you buy an Australian almond with zero tariff or a California one with 50 percent tariff? That is a decision I really don't want to see a consumer make. Will this tariff war last through the year to see this happen? China's main import

seasons for California almonds are Chinese New Year and their Fall Festivals. All of which are in the next few months. I think these will be telling times for the California almond industry.

Trade Mitigation Program

Recently, the administration saw the effect these tariffs were having on farmers across the nation. They implemented a Trade Mitigation Program for tariff

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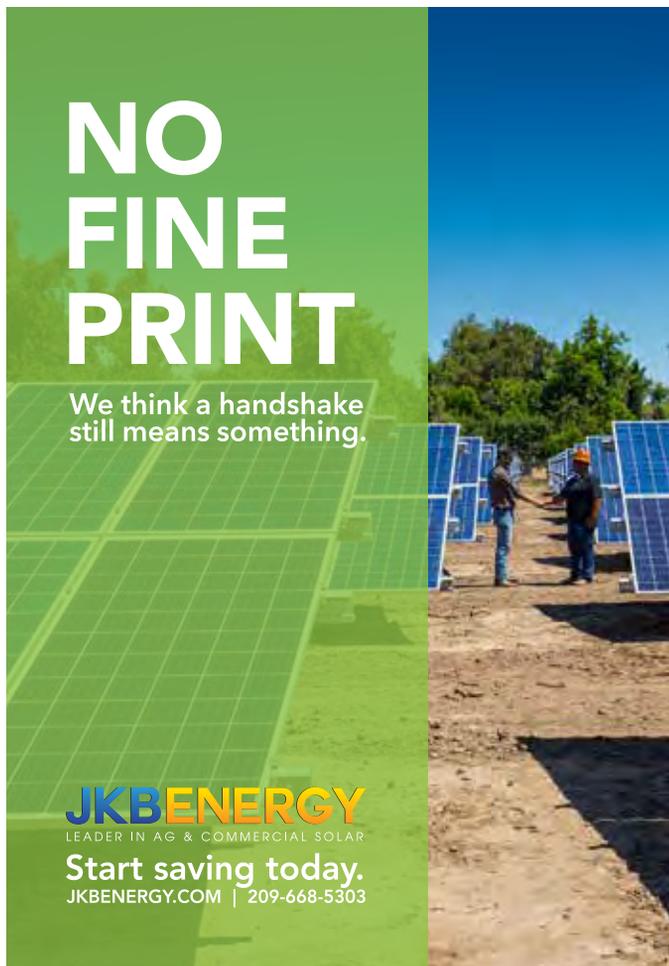
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aid to farmers and producers of nearly \$12 billion dollars. According to the United States Department of Agriculture (USDA), the initial roll out includes \$6.3 billion of assistance and \$4.7 of which will be used for direct payments through the “Market Facilitation Package” of the program. This part of the program is mainly for corn, dairy, pork, soybeans and sorghum producers. Farmers will have to apply for aid based on their harvest production.

The second part of the tariff aid package includes “Food Purchase and Distribution Programs”. Included in these crops are hazelnuts, pistachios, pecans and walnuts. According to the USDA Agriculture Marketing Service, there will be an economic analysis of the damage caused by tariffs to determine the amounts of these commodities that will be purchased by the USDA. They have set target amounts for certain crops. There is also a much shorter list as part of this program that includes almonds and cherries as a ‘to be determined’. What kind of aid, if any, has not been outlined as the other crops were. There is an allocated amount of \$63.3 million for almonds which could be a combination of market facilitation and food purchase programs. This still doesn’t come close to that \$500 million value from last year.



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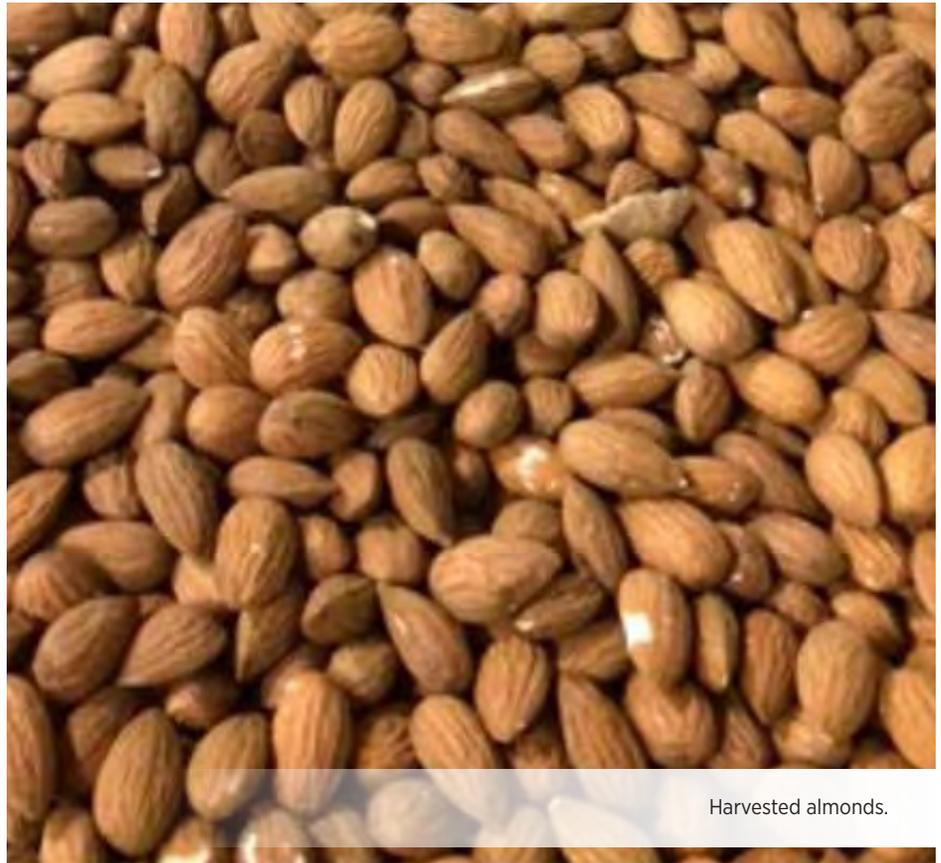
The third part of the tariff relief package includes “Agriculture Trade Promotions Program”. If this part rolls out as it sounds, then promoting and protecting agriculture trade is what we should be focusing on. A true combination of all the packages would be ideal to encourage agriculture products remain active in trade.

These tariff relief packages may appear to present opportunities for aid, it seems though there will only be a small fraction of potential losses available in relief. In a study done by University of California (UC) Davis, they project \$3 billion dollars of loss from California fruit and nut crops due to this tariff war. The total for the “Food Purchase and Distribution Programs” for all crops is \$1.2 billion. While, it seems specialty crops are once again not included in the significant amount of aid, and we are significant targets in the tariff war. It doesn't seem like the aid packages being presented will significantly help those in California being impacted by the tariff war.

The overall take away of our current tariff situation can be concluded with three words, “Trade Not Aid”. Farmers, I believe, want one thing. We want a way to sell our commodities. We are already a retail payer and wholesale seller, and now we are the collateral damage of tariffs. There have been years and decades of relationship building, research, time and dedication to exploring these markets. There have been demands created and farmers have invested into the future of their businesses because of these demands. We grow a crop because there is a need for it. Let's not get caught up in the rhetoric of politics. Trade, not aid will help our farms and our country.

Jenny Holtermann, writes an agriculture blog ‘Almond Girl Jenny’ and farms almonds with her family.

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FALL WEED MANAGEMENT —

What's the Best Approach?

By: Kathy Coatney | Editor



Almond orchard. All photos courtesy of Kathy Coatney.

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At one time growers could achieve effective weed control with a burn-down treatment of glyphosate or other post-emergent herbicides. That would take care of any weed problem they had in their orchards, but that's not the case anymore, according to Kurt Hembree, University of California Cooperative Extension (UCCE) farm advisor for Fresno County.

Good weed management requires controlling weeds before they set seed, and poor weed control in a given year can result in heavy weed pressure for several years thereafter. This makes it important to build an effective weed management program.

Weed Identification

Know your weeds is the hue and cry from UCCE farm advisors statewide.

In order to make accurate selections of pre- and post-emergent herbicides, weed identification is important. Weed populations can change over time, so it's recommended to monitor weeds twice a year. In the fall, identify summer species that were not controlled and newly emerging winter species. Monitor again in the late spring to identify winter weeds that were not controlled.

There is a free resource available through University of California for weed identification: Weed Identification Tool at the UC Weed Research and Information Center.



Hairy Fleabane that has bolted.

Herbicide Timing

Properly applying herbicides is as critical as choosing the right one. Many weeds become difficult to control at certain sizes or reproductive stages. Some materials are not easily translocated in the plant, while others are dependent on movement into the soil by either rain or irrigation. The bottom line, these materials need to be applied correctly if they are to perform as expected.

Before applying a pre-emergent, remove leaves and debris from the orchard, and replace old and worn nozzles. It is more cost effective to change nozzles than to make ineffective herbicide applications that result in inadequate weed control.

Herbicide Resistance

Some of the current weed management challenges in orchards are related to herbicide resistance, particularly resistance to glyphosate. Glyphosate, a post-emergent herbicide has been the go-to weed control for many years, mainly because it has a broad weed control spectrum and it is economically priced.

Heavy reliance on glyphosate has led to several broadleaf and grass weed populations becoming resistant. An effective weed management program should include herbicide rotations, tankmix combinations, sequential treatments, and incorporation of non-chemical strategies to

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control current resistant populations and to reduce the risk of more resistance building in other weeds.

Pre-emergent Herbicides

There have been several new registrations of pre-emergent herbicides for nut crops. Alone or in combinations, these herbicides can provide very good control, often for months after application.

Pre-emergent herbicides are more expensive, but they can eliminate the need for one or more spray applications. Also, most of the pre-emergent herbicides registered for orchard use are from different mode of action groups than the post-emergent herbicides which helps prevent resistance from occurring.

The important thing to remember with pre-emergent herbicides is that they have to be incorporated into the top layer of soil where weed seeds germinate. This is done preferably by rainfall, but irrigation can also be used. A quarter to half an inch of water is recommend-



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Tank Mixing and Sequential Applications

Using tank mixes or sequential herbicide applications is advised to increase control and reduce resistance.

Tank mixes can be done in several ways:

- Pre-emergent and post-emergent herbicides to control weeds that have emerged and provide residual control.
- Combining herbicides with activity on grasses with other materials that have broadleaf activity.
- Combining materials that have different modes of action, but overlapping activity on weeds where there is concern that resistance will develop.

Follow Up

It's important to follow up during the year with field scouting and cleanup operations. For a weed management program to be effective, it's important to have data of actual weed counts and ratings, or a manager's mental assessment after walking or driving through the orchard multiple times during the season.

Integrated weed management should be constantly evolving and fine-tuned based on what is or is not working. Field scouting is also an opportunity to identify and manage problems like new species or suspected herbicide resistance before the problem becomes unmanageable. This can save a lot of time and expense later.

Fall Weed Management

Hembree said, as growers finish harvest they will move to fall weed management.

"They'll go in there with an early burn down just to stay ahead of their winter program," Hembree said.

Pre-emergent applications won't go on until after the first rain, Hembree

continued.

"We haven't had any forecast for rain, so unless we get rain in September/October you won't see any pre-emergence going out," Hembree said, adding it will just be contact herbicide applications.

Typically growers see recovery in some of these weeds after harvest, and they make an herbicide application before the weeds harden off, Hembree said.

"This really is the ideal time to get them down because it might be another two months before they spray for the winter program," Hembree said.

Generally growers wait until after the first rain to apply a pre-emergent, Hembree said, and this year the predictions are for a wet December.

"Typically we'll get some rains in November, so you'll see some treatments go on early to mid-November if we get a couple of rains," Hembree said.

Waiting too long to apply a pre-emergent isn't a good idea either. The weeds need to be treated when they are still small, Hembree said.

Problematic Weeds

Malva or the cheeseweed are problematic weeds for Hembree's growers. There can also be problems with Chickweed, annual bluegrass and annual sow thistle. Hairy fleabane is another of the problematic weeds that growers are contending with, he said.

"Those fleabanes kick into gear in October/November, and so they don't want those to overwinter," Hembree said.

That's really the target time for a lot of those types of plants that are problems for our area, and if we have rain by November they're already starting, Hembree said.

"So it's really important to be ahead of that," Hembree said.

Continued on Page 64



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Walnut Orchard.

Continued from Page 63

“The one that we’re seeing problems with, and they’ve documented resistance in other parts of the world, is this annual sow thistle and prickly lettuce. We’re finding more of this sow thistle that is coming up in October, November, December, and kind of like Fleabane, tends to harden off,” Hembree said, adding glyphosate and the burn down products don’t treat it very well in January, February, March when it starts to regrow.

Preventing Resistance

Preventing resistance comes down to using tank mixes and rotating chemistries, Hembree said.

“There are a lot of tank mixes nowadays,” Hembree continued.

“My recommendation has always been, on these pre-emergents particularly, that you should have at least two different modes of action in every spray tank,” Hembree said, adding that tends to keep resistance at bay.

Using one chemical is a recipe for disaster. “You really need to mix it with other materials as well. That just makes a lot of sense when you look at the resistance that’s occurred over the years,” Hembree said.

Hembree recommends the International Survey of Herbicide Resistant Weeds (ISHRW) website as a good resource for growers.

“Anytime there’s any report of new species, resistance, herbicide changes, it’s all in there... You can go to California and find out where the resistance was, what was used, all that kind of stuff,” Hembree said.

For more information go to the ISHRW website at: <http://www.weedscience.org/default.aspx>.

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Where Things Stand With Chlorpyrifos

By: Jodi Raley | Director of Regulatory Affairs,
Western Agricultural Processors Association
(WAPA)

For the past several years, chlorpyrifos, most commonly known as Lorsban, has remained on the chopping block for both federal and state agencies. The numerous petitions, restricted use provisions, hearings and rulings have culminated to a court decision that would ultimately revoke all U.S. tolerances and cancel all registrations of the product.

Chlorpyrifos has been a chosen tool for producers, being used for the past 50 years on over 50 different commodities. In particular for tree nuts, it has been a critical crop protection tool for pests such as twig borer, navel orangeworm and mites for almonds; codling moth and walnut husk fly in walnuts; and pecan nut casebearer and black pecan aphid for pecan producers. As crucial as chlorpyrifos is to control these pests, a greater debate is on the table in regards to the direction that this country and our state will evaluate crop protection tools moving forward.

Proposed Ban on Chlorpyrifos

In late 2015 the Environmental Protection Agency (EPA), under the Obama Administration, proposed a ban on chlorpyrifos under the guise of it posing as a neurodevelopmental risk. A strong component of the agency's reasoning for the ban was a study from Columbia University. This study, both controversial and precedent-setting, has raised concern not only from industry but from the agency's own Scientific Advisory Panel. The panel cited in their 2016 review that they had significant concerns in regards to the quality of the study's data due to the fact that the raw, scientific data of this study has never been made available to the agency. Our Association, and other agricultural groups, have pushed back on using an ambiguous study for such precedent-setting action. Even more so, using

this study is in stark contrast to the rigorous requirements that registrants must go through to have a product registered, often costing hundreds of thousands of dollars and several years' worth of evaluations. It was for this very reason that EPA Administrator Scott Pruitt made the decision last year to reverse the 2015 proposed ban. Many supported the decision, as it signified the agency's return to relying on sound, scientific science when making regulatory decisions.

Chlorpyrifos Listed as Restricted Material

Meanwhile in California, chlorpyrifos was facing a battle of its own. Beginning in 2015, chlorpyrifos was listed as a restricted material in California, requiring additional mitigation measures and more monitored use. Additionally, within the past year the product has been under evaluation by not one, but two state agencies, the Department of Pesticide Regulations (DPR) and the Office of Environmental Health Hazard Assessment. DPR's Scientific Review Panel rigorously reviewed the product to evaluate its potential listing in the Toxic Air Contaminant Program. Among the data that was used, an example of the overly-conservative, egregious modeling the agency utilized, was a scenario that assumed a child would be standing downwind from a chlorpyrifos application for 21 DAYS straight! This scenario, while not only extremely detached from modern day agricultural practices, would be illegal as there is no federally registered label allowing this kind of use! Additionally, the panel continually recommended consideration of data from the Columbia Study. Last month, the department decided based off of the review panel's recommendation to list chlorpyrifos as a toxic air contaminant.

Continued on Page 68

Almond orchards. All photos courtesy of Kathy Coatney.

Almond orchard.



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Continued from Page 66

Where are we Now?

So where are we now? In California, following the department's Toxic Air Contaminant Listing, the agency will now undergo rulemaking, including public comment periods and a hearing, to effectively mitigate the product. An even greater issue at hand is where the product stands at the federal level. On August 9th, the U.S. Court of Appeals for the 9th Circuit ruled that EPA failed to justify former Administrator Pruitt's decision to reverse the ban. This recent decision calls for the revocation of all U.S. tolerances and the cancellation of all registrations for the product within 60 days. While the decision had no immediate effect on the use and sale of the product, the time is ticking. EPA has until September 24th to decide if the agency will request a rehearing on the matter. If requested, it would put a pause on the mandate until a final decision is made. However, if September 24th comes and goes with no rehearing request from the agency, a seven-day window of time is given for the Agency to prepare to comply with the mandate, effectively beginning the revocation and cancellation within 60 days starting October 1st.

There is more at stake in these discussions than just the product itself. We are seeing decisions made that effect agricultural production basis of studies that do not produce actual data to government agencies and appointed review panels using modeling and scenarios that are overly-conservative and detached from real world production. The Western Agricultural Processors Association has been fighting tooth and nail, to remind EPA and Cal/EPA that their mission is to utilize the most available, sound-scientific data when making regulatory decisions. WAPA has commented, testified and opposed these recent actions and will continue to do so to prevent this same fate on other crop protection tools.

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Frost Control for Almonds— Fans, Polymer Products, Water & Air

By: Cecilia Parsons | Associate Editor

Like in citrus, just raising the orchard temperature two degrees can make a difference in protecting an almond crop from a freeze.

Dormant almond trees can tolerate freezing temperatures, but once buds begin to swell, the harm caused by late winter/early spring freeze increases. Significant crop loss can occur from petal fall to early nutlet development when temperatures fall below 26 degrees F. Management strategies that can raise orchard temperatures by just two degrees can save much of the crop.

Research done by University of California (UC) bio-meteorologist Richard Snyder and Cooperative Extension (UCCE) advisor Joe Connell shows that minimum temperature, length of time at that temperature, the presence of ice-nucleation active bacteria and frost hardiness of the

variety all determine the possibility of ice forming inside the plant tissue and causing damage.

Snyder said that early defoliation of trees in the fall due to water stress or insect damage the previous fall increases susceptibility of almond buds to frost damage. Trees need adequate irrigation and pest management to allow them to store carbohydrates. That supply helps the trees withstand freezing temperatures.

In a severe freeze event, ice forms on plant surfaces due to the presence of ice-nucleation—active bacteria on the surface. The ice forms inside the plant tissue, but outside of the plant cells. Freezing injury happens to buds, flowers and nuts when ice forms, the cells dehydrate and the cell walls are damaged.

Advection and Radiation

There are two types of freeze events: advection and radiation. Advection is when cold air moves in and replaces warmer air. The type of event is characterized by low humidity, no inversion layer and windy conditions. There are few effective protection measures against an advection frost. Radiation frosts are more common in almond production areas. They occur due to a net loss of radiant energy. Inversion layers aloft are found with radiation frosts and the stronger the inversion the better most frost protection strategies will work.

Injury from freezing temperatures is due to net heat loss from an orchard. There are four mechanisms that transfer heat in or out of an orchard: radiation, conduction, convection and latent heat. All orchard protection methods use one or more of these to reduce heat loss or replace heat.

Radiation is energy emitted from any source that has a measurable temperature. Orchard floors radiate heat, and the larger the area, the more heat is lost. Air, which contains heat, also radiates energy in both upward and downward directions.

Convection

Convection occurs when heated air becomes less dense and rises. Similarly, cold air is more dense than warm air and sinks. On frost nights, cold-air drainage occurs because the cold, dense air flows downhill much like water.

Orchard heaters, wind machines and helicopters used force



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convection to move warmer air aloft down to the trees.

Conduction transfers heat through the soil and is an important factor in orchard protection. Soil heat storage can be maximized by maintaining soil moisture near field capacity, especially following a dry winter.

Latent heat is an important factor in any frost protection plan that involves water. Dew or frost formation on almond buds, flowers, or small nuts actually protects against damage. Dew or frost formation releases latent heat to the plant parts and air. This heat slows or stops temperature drop. When no dew or frost forms (that is, when the dew point is low), damage is more likely.

Frost protection methods seek to reduce heat loss, redistribute heat, or add heat to an orchard. In all cases, the idea is to balance the net heat loss. This can be accomplished by reducing the upward radiation, enhancing heat conduction in soil, improving air convection, or

increasing downward radiation.

Passive Frost Protection

Freeze protection strategies begin with site selection for an almond orchard. If the site has low places where cold air flows, additional protection measures will be necessary. Planting on slopes where cold air can drain away is recommended. In existing orchards, identifying the cold spots is part of the protection strategy.

Planting on north facing slopes, can also delay bloom until after freezes are likely to occur. Any structures or vegetation that diverts cold air into an orchard site increases freeze potential. These can also be used to block the downward movement of cold air away from the site.

Soil water content affects thermal conductivity and heat content of soils. Heat is transferred daily into and out of the top foot of soil. When the soil is wet,

the heat transfer and storage improves and more heat is stored during daylight hours for release at night. Snyder's research showed that wetting the top foot of soil aids in heat transfer when the soil is dry prior to frost season.

How soon the soil should be wetted prior to a forecasted freeze also depends on the type of soil. Clays are better at storing heat than sandier soils.

Using Water to Raise Orchard Temperatures

Managing soil moisture and ground cover can help reduce frost damage in a radiation freeze event. Heat is retained in moist soil and radiates upward during cold nights. Ground covers, if left unmowed, can pull the moisture out, but prevent it from rising.

A few days advance warning of a freeze event can help when using micro sprinklers or solid set sprinklers for frost

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protection. If soil surface is already wet, using flood or drip irrigation will not provide adequate protection. Once the surface water freezes, no heat is released. Drip lines may also freeze. With micro sprinklers, heat is released off the water. Snyder and Connell's research found that targeted amounts of water should be 30-40 gallons per minute per acre.

Determining the right time to initiate wetting the soil and turning off the sprinklers is important.

Sprinklers should be started and stopped when the wet-bulb temperature is above the critical damage temperature. When a sprinkler system is first started, the air temperature in the orchard will fall to the wet-bulb temperature. This initial drop in temperature will be followed by an increase as water freezes on the ground and plant parts and heat is released. Sprinklers should

not be turned off until the wet-bulb temperature is above 32 degrees F.

Snyder explained that the wet-bulb temperature can be measured directly with a psychrometer or it can be determined from the dew point and air temperature.

Wind Machines are Another Option

Wind machines are another option in freeze damage prevention in almonds. Although they are not common in most almond production areas, wind machines can protect the crop by raising orchard temperatures above critical points. Wind machines work by pulling down the warmer air aloft and moving air to prevent pooling of cold air. By providing air movement across a plant surface, super cooling is prevented. Damage occurs with loss of air movement. Wind machines do not create wind chill.

Shawn Miller of Orchard-Rite Wind Machines said their new designs give

growers more options in freeze protection. These include an automatic system that starts, warms up, throttles up, throttles down, cools down and shuts off based on pre-set temperatures. They also allow for remote monitoring and management via the Internet and a mobile device.

Other new options in wind machine design are custom and tilt heads to protect crops on uneven terrain, covering areas that normally would require two machines.

Other Protection Options

Two newer freeze damage protection measures include polymers applied to plants and cold air drains.

Cold air drains are a mechanical means of warming the air in an orchard. These machines work best in site specific areas—low areas where cold air pools. The cold air is expelled upward by the drain and it mixes with warmer air aloft. Its ability to raise orchard temperatures depends on the strength of the inversion layer.

These portable machines were designed in the late 1990s and have mainly been used in vineyards planted on hilly terrain.

The Australian company AgroBest developed a seaweed based product for frost protection. It's potassium additive provides protection to the plant within 6 hours of application, and the seaweed will continue protection after 36 hours to keep plants protected for a period of 10-12 days. The company states that the product will provide approximately 2-3 degrees of extra frost tolerance.



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SPOTLIGHT on Grades & Standards Committee

By: Walnut Board | Contributing Writer



Committee Chair Frank Guerra.
Photo courtesy of Frank Guerra.

As walnut growers know, the California Walnut Commission and Board is funded by assessments on walnut growers and handlers. These assessments are then used for the benefit of the industry through marketing campaigns, funding various research projects, and promoting California walnuts in general. These funding decisions are made by different committees consisting of industry members that are tasked with setting research priorities and vetting project proposals so that the industry gets the best bang for the assessment buck. One of the committees is the Grades & Standards Committee, chaired by Frank Guerra, a fourth generation walnut grower and handler. So, what exactly does this committee do?

Vetting Project Proposals

Broadly speaking, it deals with grading of walnuts, vetting project proposals that will benefit the industry, and address food safety, quality and related regulatory issues. For example, the Grades & Standards Committee recognized the need for helping walnut growers fulfill their Food Safety Modernization Act (FSMA) training requirements (at least one person trained per farm) and allocated funds for complimentary grower training. To date, there have been 13 trainings throughout the Central Valley, attended by some 900 walnut growers. Some of you may have taken advantage of this sponsored training. The California Walnut Board was the first commodity group to fund grower trainings.

Projects

For the past few years, the Grades & Standards Committee has been focused on basic food safety research to better understand what the industry challenges are in the growing, harvesting, hulling and dehydrating and finally, processing steps, so that these can be better addressed. In addition, there is also funding for annual pesticide surveys that has shown no multi residue level (MRL) exceedance, an indication of how California walnut growers apply chemicals responsibly and in strict accordance with label guidelines. More recently, the committee has started to shift its attention to projects that can help extend the product quality and shelf life as the Walnut Board aims to make walnuts the number one nut of choice for snacking, processed products (cereals, chips) and everyday usage. To that end, there are efforts to understand relationships between orchard management factors such as irrigation timing

and quantity and kernel color, effect of drying and modified atmosphere storage conditions on quality, and so on. This exciting new phase of research will eventually help position walnuts as not only the nut with the best nutritional profile (highest omega 3 fatty acids) but also with plenty of shelf life to be used in shelf stable products such as trail mixes, cereals, granola bars, etc.

Additionally, attention is also being given to projects focused on utilization of walnut hulls and shells in products like bioplastics, natural filler in tires, biochar for soil nutrition, and so on, so as to use as much of the entire walnut as possible.

As you can see, the Grades & Standards Committee covers quite a wide range of topics that go beyond setting grading standards. Committee Chair Frank Guerra, a grower and a handler himself, is well positioned to know firsthand

what some of the industry needs and challenges are, while setting the committee's direction.

Wishing you a great 2018 harvest season!

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FARM EMERGENCIES— Preparedness and Compliance

By: Amy Wolfe | MPPA, CFRE
President and CEO, AgSafe

As our state suffers yet again from another horrendous fire season, it begs the question, what happens when these natural disasters effect our farm and employees? Before we begin navigating preparedness and emergency procedures, let's first take a look at what is legally required of our operations specific to emergency response.

The Law

Emergency action plans are required at both the federal and state level. Federal Occupational Safety and Health Administration (OSHA) outlines its requirements in the Code of Federal Regulations, Section 1910.38 and Cal/OSHA has delineated the state requirements in the California Code of Regulations, Title 8, Section 3220. Both standards detail what an Emergency Action Plan should entail, including the following:

- Procedures for emergency evacuation, including type of evacuation and exit route assignments.



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- Procedures to be followed by employees who remain to operate critical facility operations before they evacuate.
- Procedures to account for all employees after emergency evacuation has been completed.
- Procedures to be followed by employees performing rescue or medical duties.
- The preferred means of reporting fires and other emergencies.
- Names or regular job titles of persons or departments who can be contacted for further information or explanation of duties under the plan.
- An alarm system for notifying employees of an emergency.
- A plan for emergency evacuation.
- Training:
 - » Before implementing the emergency action plan, the employer shall designate and train a sufficient number of persons to assist in the safe and orderly emergency evacuation of employees.
 - » The employer shall advise each employee of his/her responsibility under the plan at the following times:
 - Initially when the plan is developed.
 - Whenever the employee's responsibilities or designated actions under the plan change.
 - Whenever the plan is changed.
- The employer shall review with each employee upon initial assignment those parts of the plan which the employee must know to protect the employee in the event of an emergency. The written plan shall be kept at the workplace and made available for employee review.

To assist you in developing you plan, Michigan State University has a comprehensive template to help you get started: http://www.maeap.org/uploads/files/EMERGENCY_PLANNING_fillable_Form_E2575-ET_AA.pdf.

Emergency Procedures

Having the plan in place doesn't really help during an emergency, unless you have thoughtfully created emergency procedures that can easily be followed and understood by employees.

There are a number of key elements to address when developing a robust emergency action plan.

General Emergency Procedures:

- Alarms—Employees will be notified of an emergency situation verbally, by radio, cell phone or in person. Buildings are equipped with various alarms.
- Emergency Gathering Locations—Identify the area(s) where employees are to gather in case of an emergency.

- Create evacuation procedures for all locations, including but not limited to:
 - » Offices
 - » Barns
 - » Shops
 - » Labor houses
 - » Fields/orchards/vineyards
 - » Processing facility

Earthquake Procedures:

- After an earthquake,
 - » Supervisors identify any employee who may be injured.
 - » Supervisors should check for: gas leaks, downed electrical lines, fuel leaks, hazardous waste containers, or gas cylinder damage.
 - » Turn off electrical power, valves (gas/propane), and water if necessary.
 - » Be careful around shelves, storage areas and unstable buildings.

Fire Procedures:

- Notify everyone in the area to evacuate and meet at the designated location.
- Call 911 or activate the fire alarm before attempting to put out fire with extinguisher or hose.
- To the safest extent possible, do not let the fire get between you and the way out.
- Watch to make sure it doesn't reignite.
- Supervisors must perform a head count of all employees.

Flooding and Severe Weather Procedures:

- It is the employer's responsibility to decide to stop work early in case of severe weather. The decisions will vary by operation and weather affects areas differently.
- The decision to stop work should be made as early in the day as possible and be communicated down the chain of command.
- Office staff should be notified if the office needs to be closed.
- All managers and employees are expected to use good judgement and not take unnecessary risks.

Medical Emergency Procedures:

- Evaluate the situation and condition of employee.
 - » If serious or life threatening:
 - Call 9-1-1 immediately—DO NOT WAIT for a supervisor.
 - Administer appropriate first aid and/or CPR.
 - Designate an employee to stay with the victim until the emergency responder arrives. Do not leave a seriously injured person alone.
 - » If not life threatening:
 - Report the injury to a supervisor via radio or cell phone.
 - Administer appropriate first aid and/or CPR.
 - Wait for the supervisor to provide a plan of action, including who will transport the employee to the nearest health care provider.
- Be sure to have emergency contact information for all employees.

Contact Information

Date: _____

Employee Name: _____

Mailing Address: _____

Primary Phone Number: _____

In case of an emergency, please notify:

Name: _____

Contact Numbers: _____

Work: _____

Home: _____

Cell: _____

Physician:

Name: _____

Contact Number: _____

Insurance: _____

Policy Number: _____

Signature of Employee: _____

Be sure to have emergency contact information for all employees. Photo courtesy of AgSafe.

Wildfire Procedures:

Wildfires present hazards that employees must understand. Hazardous conditions are not always visible. Smoke from wildfires contains chemicals, gases and fine particles that can harm health. Smoke can hurt eyes, irritate the respiratory system,

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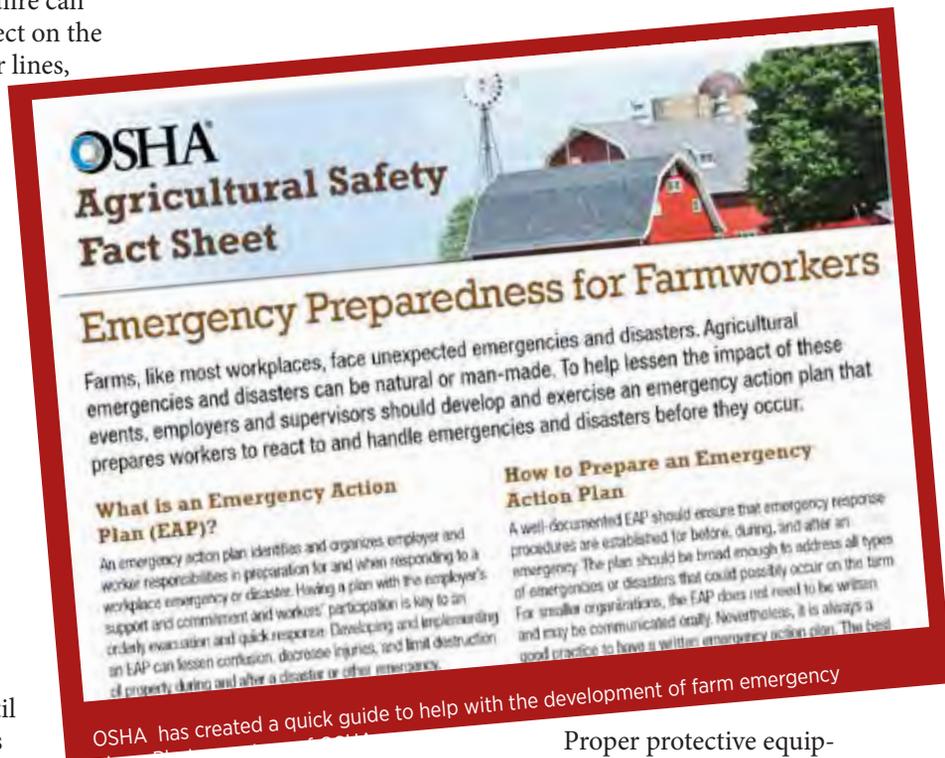
and worsen chronic heart and lung diseases. These symptoms may continue even after fires have been extinguished and cleanup work begins. The aftermath of a wildfire can cause injury, illness, and even death due to its effect on the environment, the soil, structures, electrical power lines, poles, fuel tanks, hazardous material released by the fire or during firefighting measures.

Potential hazards in wildfire areas include, but are not limited to the following:

- Fire and fire byproducts including smoke
- Electricity and flammable gases
- Unstable structures
- Demolition and excavation
- Sharp or flying objects
- Confined spaces
- Carbon monoxide poisoning
- Ash, soot, dust
- Asbestos
- Hazardous chemicals and substances
- Heat illness

Before work begins on a wildfire affected area, all electrical and other utilities will be turned off until an exhaustive inspection is conducted. Fuel tanks will be locked out and tagged out. No one will be

authorized to enter the area until a thorough inspection has been completed and the employer's designee says it is safe to do so.



Proper protective equipment and training is required for worker safety in wildfire regions. Wear protective gear when entering contaminated areas including the appropriate respirator, safety glasses, boots, hard hat, gloves, long sleeve shirts, long pants, and other protective clothing as required by the chemical Safety Data Sheet(s) of all materials on hand, released into the air by fire, or spilled.

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Other Emergency Plans to Consider:

- Hazardous Material Spill Containment Plan and Procedures
- Spill Prevention, Control and Countermeasure Plan—if applicable
- Fire Prevention Plan
- Respiratory Protection Plan

For a quick guide on farm emergency plans visit, <https://www.osha.gov/Publications/OSHA3870.pdf>.

This serves as a brief overview of emergency farm preparedness. If you have questions about the specifics, including a sample farm emergency plan, visit www.agsafe.org, call (209) 526-4400 or send an email to safeinfo@agsafe.org.

AgSafe is a 501c3 nonprofit providing training, education, outreach and tools in the areas of worker safety, human resources, food safety, and pesticide safety for the food and farming industries. Since 1991, AgSafe has educated nearly 75,000 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

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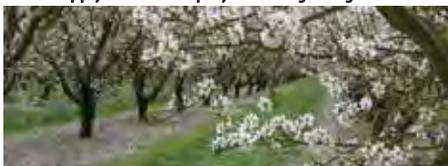
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7.5-1-25
5-7-14
11-8-8

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ALMOND FERTILIZER PROGRAM

Apply as a Foliar Spray or Through Irrigation



AT PETAL FALL – APPLY ONE POUND PER ACRE OF
PPD – PURE PROTEIN DRY 15-1-1



WHEN DIME SIZE – SPRAY 2 POUNDS /ACRE PPD



SPRAY 3 WEEKS LATER – 2 LBS/ACRE CAN ADD EX-ICUTE
FOR MITE CONTROL WITH THE PPD - IN ONE SPRAY



3 WEEKS BEFORE HARVEST 1 TO 2 LBS/ACRE PPD,
CAN APPLY EX-ICUTE WITH PPD IF MITES PERSIST



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Tulare, CA 93274

October 26, 2018

Mid-Valley
Nut Conference

Modesto Jr. College Ag Pavilion

2201 Blue Gum Ave,
Modesto, CA 95358

November 2, 2018