WEST COAST NUT

March 2017 Issue

In This Issue:

JCS MARKETING PUBLICATION

Photo Credit: Kathy Coatney

INSPECTION MASTERS LLC

Advanced Automation Technology for Agriculture

Breakthrough in Hulling Line Sorting

"Using the WHS sorter we were able to eliminate 6 pickers and speed up our hulling line by half."
—Peter Vink, Tracy, CA

Models available from ***5–30 tons*** *per hour*

WHS Series sorters have successfully sorted Walnuts from Los Molinos south to Hughson.

Among the exclusive, advanced features are:

- *Dual Sort in a Single Pass – good walnuts, separated from blacks, separated from greens – all in one pass. No secondary sorter required.*
- *Tightly spaced, computer-controlled, pulsed air ejectors for precise ejection of rejects. Fewer misses and fewer false rejects.*
- *Cameras separated and shielded from ejectors. The camera window stays clean, thus maintaining consistent sorting performance.*

Contact us today for an evaluation of your hulling line, and to learn how a WHS Series Walnut Hulling Line Sorter can improve your operations… and your bottom line. We look forward to visiting with you.

See video of all locations in action on our website. **www.inspectionmasters.net**

INSPECTION MASTERS LLC
Advanced Automation Technology for Agriculture
Las Cruces, NM (575) 647-8203

North of Sacramento Sales
Troy Busby
(530) 661-9067
troybusby@inspectionmasters.net

South of Sacramento Sales
Don Sieling
(650) 228-9260
donsieling@inspectionmasters.net

JCS MARKETING
PO BOX 27772 | FRESNO CA | 93729

Publisher: Jason Scott
Email: jason@jcsmarketinginc.com
Editor: Kathy Coatney
Email: kathy@jcsmarketinginc.com
Production: Logan Willems
Email: logan@jcsmarketinginc.com
Tel: 559.352.4456
Fax: 559.472.3113
Web: www.wcngg.com

Change of Address?
Visit our website to complete the change of address form under the subscriptions tab.

WEST COAST NUT

By the Industry, For the Industry

IN THIS ISSUE

View our ePublication on the web at www.wcngg.com

PRECISION FARMING

With recently developed electronic measuring techniques, a high-tech equivalent of the old-fashioned dendrometer is becoming an important tool for hi-tech tree and vine growers.

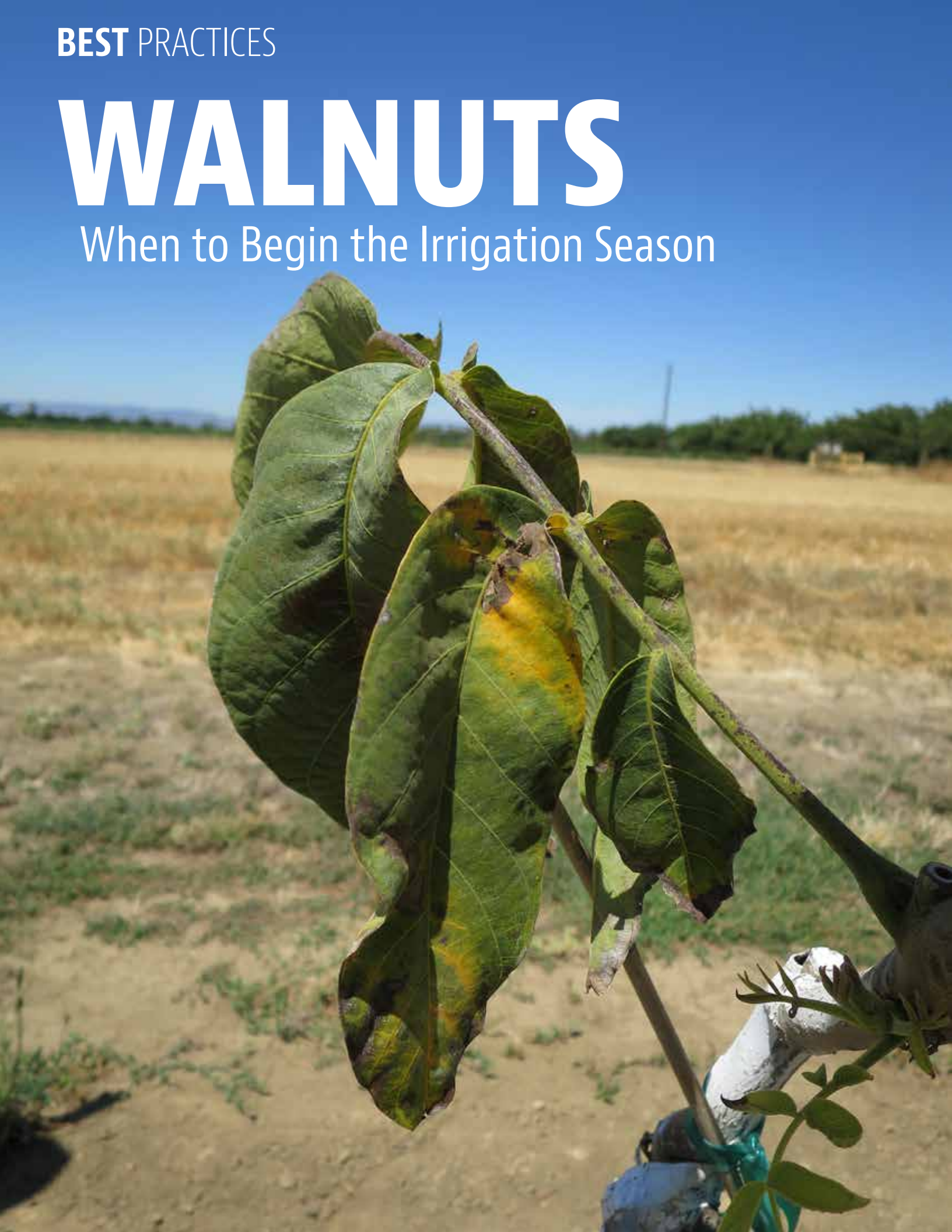
See the full story on page 48

Photo Credit: Smithsonian Environmental Research Center's Global Tree Growth Project.

BEST PRACTICES

WALNUTS

When to Begin the Irrigation Season



Allan Fulton
UCCE Farm Advisor, Tehama County

Bruce Lampinen
Integrated Orchard Management, Davis, CA

Ken Shackel
UC Professor Department of Plant Sciences, Davis, CA

Overly aggressive, early irrigation can saturate soils and deprive roots of necessary oxygen to grow. Soil fungal pathogens such as Phytophthora thrive in saturated soils and can infect tree roots. The result is declining tree health, productivity, and higher incidence of tree death. **Figure 1** displays an assortment of disorders that have been observed and associated with extended periods of overly wet soil conditions, particularly in the spring (April, May, and early June). When orchard water stress is monitored with a pressure chamber and midday stem water potential (SWP) levels are steadily near or above predicted baseline levels for fully irrigated conditions, these types of disorders are more likely to occur.

Delaying the start of irrigation too long can result in trees that are stressed from the lack of water. Impacts may include a decline in shoot growth and a visible reduction in the rate of nut sizing after flowering. Smaller walnuts may cause declines in yield as a result of lower kernel weight. When delays in spring irrigation are followed by inadequate irrigation in the summer and fall, it may lead to even higher crop water stress and more impact on kernel weight, color, and bud development for next year's crop.

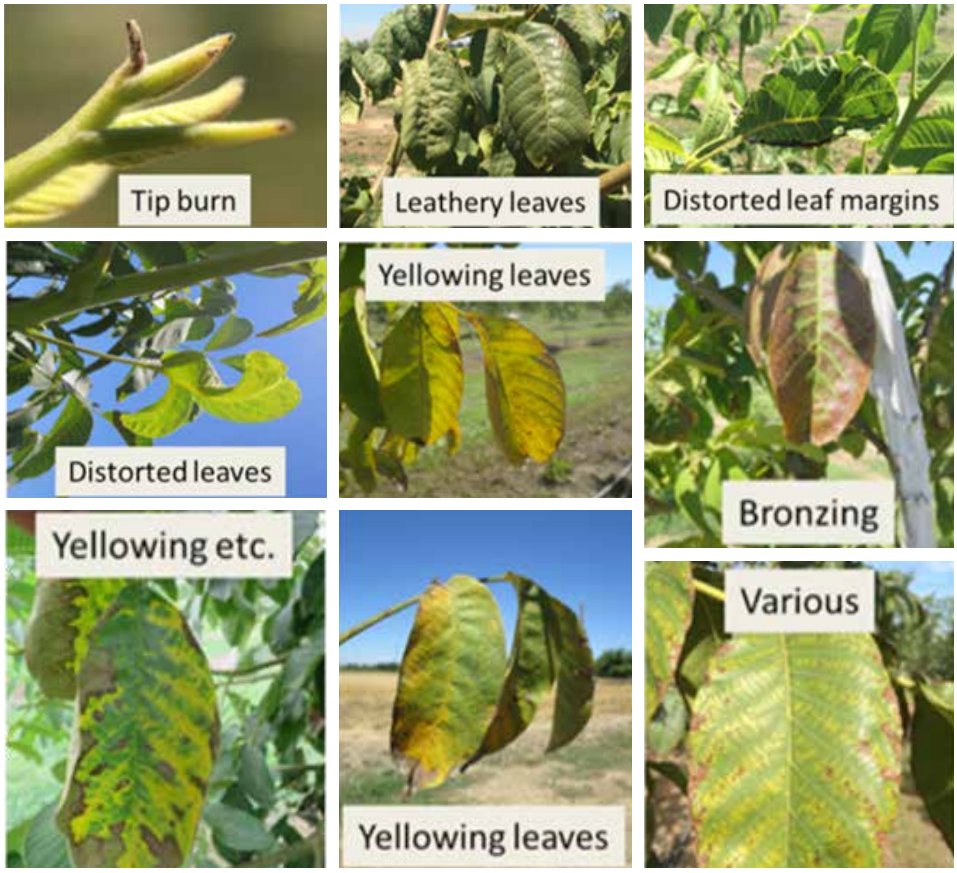


Photo Credit: Bruce Lampinen

Figure 1. A variety of plant disorders: tip burn, leathery and yellowing leaves, and bronzing have been observed and associated with over-irrigation.

Photo Credit: Ken Shackel

Figure 2. General layout of UC irrigation experiment in a commercial walnut orchard. A randomized and replicated experiment evaluating a wide range in irrigation start dates. Rectangles of same color are ½ acre plots where the irrigation start date was initiated at similar levels of orchard water stress.

Experimenting with Irrigation Start Date

A randomized and replicated experiment has been sponsored by the California Walnut Research Board since 2014 in a commercial Chandler/Paradox walnut orchard. **Figure 2** uses a Google Earth image to illustrate the general experimental layout.

The experiment is located in the northern Sacramento Valley near Red Bluff, California. In 2014, the orchard was 9 years old. The orchard planting configuration is 28 by 18 feet. Soils are well drained, Columbia silt loam and fine sandy loam. A solid set minisprinkler system is used to apply irrigation water. Mechanical hedging has been practiced since 2012 with every fourth center hedged annually. Supplemental hand pruning has been practiced primarily to control the size of every other tree in anticipation of tree removal to increase tree spacing in the orchard. Tree spacing was closer to achieve earlier orchard production but wider tree spacing is of interest over the life of the orchard to optimize light and humidity in the orchard and lessen pressure from

Continued on Page 6

Table 1. Cumulative, three-year effects of orchard water stress levels on irrigation start date, dry in-shell yield, and relative water savings measured in 2014, 2015, and 2016.

Tree Stress Just Before First Irrigation (bars below baseline)	Approximate Irrigation Start Date	Approximate Days After Leafout	Dry In-shell Yield (lbs/acre)	Yield Loss % of highest yield	Relative Water Savings (%)
At or Near Fully Irrigated Baseline[1]	Late April to Early May	25 to 35	14,051 a [2]	0 %	0
1.0	Mid to Late May	45 to 60	13,780 ab	-2 %	10
2.0	Early to Mid June	60 to 75	12,925 ab	-8 %	19
3.0	Mid to Late June	75 to 85	12,591 ab	-10 %	34
4.0	Late June to Early July	85 to 95	11,827 b	-16 %	30

[1] The fully irrigated baseline represents no tree water stress when soil moisture in the root zone is not depleted at all. For more information about the baseline concept and how to predict it refer to http://informatics.plantsciences.ucdavis.edu/Brooke_Jacobs/index.php
[2] Dissimilar alphabetic letters indicate average yields that are significantly different.

Continued from Page 5

various foliar diseases that can infect buds, flowers, and nut set.

In this experiment, a large window of time (more than 90 days after leafout) has been evaluated to observe the effect of irrigation start on Chandler walnut. There are many objectives in performing this experiment ranging from improving our understanding of physiological responses of walnut to different levels of water stress, to field testing and determining the accuracy of automated devices for monitoring plant water stress. This article focuses on one key objective which is to test five threshold levels of SWP measured with a pressure chamber as indicators for optimizing the decision of when to begin the irrigation season.

Effect of Crop Water Stress Level on Irrigation Start Date, Yield, and Water Savings

Table 1 summarizes the five SWP thresholds that were evaluated in this experiment and the effect on timing the start of irrigation. The SWP thresholds

Continued on Page 8

CALIFORNIA WALNUTS

AN INDUSTRY WORKING TOGETHER TO BUILD DEMAND

We're building on the momentum of last year's campaign with seven months of TV advertising, and eleven months of print and digital support.

Our TV commercials emphasize versatility by showing consumers easy-to-prepare recipes that deliver the great flavor and satisfying crunch of California walnuts, as well as their health benefits. The ads will be seen nationally on highly efficient cable TV networks like the **Food Network** and **Fox News.**

Impactful print ads feature even more diverse usage suggestions, including new ads showing appetizers and snacks, in top-selling cooking and women's service publications like **Cooking Light** and **Good Housekeeping.**

Website, PR and social media distribute hundreds more recipes and focus on the health benefits of California walnuts to further build demand.

The result? Our advertising will be seen by 93% of Adults 25-54 an average of 26 times.

CALIFORNIA Walnuts www.walnuts.org

walnuts.org

American Heart Association CERTIFIED Meets Criteria For Heart-Healthy Food

Per one ounce serving.

Photo Credit: Bruce Lampinen

Tip burn on leaves associated with over-irrigation.

Continued from Page 6

included irrigating when SWP was near the fully irrigated baseline which indicates no crop stress; and delaying start of irrigation until SWP averaged at least 1.0, 2.0, 3.0 or 4.0 bar(s) below baseline for two consecutive measurements.[1] This range in midday SWP levels corresponds with minimal to severe levels of walnut water stress. Irrigation start dates began as early as late April and have been delayed as late as early July. Said differently, the earliest start of irrigation began about 30 days after Chandler leafout, the intermediate stress levels triggered the start of irrigation 40 to 80 days after leafout, and the most extreme stress levels delayed the start of irrigation for about 90 days. After the first irrigation was applied on all treatments, the plots were irrigated with the same amount, frequency, and duration of water for the remainder of the season.

Table 1 (Page 6) also shows cumulative dry-inshell yields from 2014 through 2016. After three years, there has been a statistically and economically significant separation in dry in-shell walnut yield between plots where irrigation was started the earliest and the latest (start at or near baseline versus 4.0 bars below baseline or about 30 versus 90 days after leafout). Cumulative dry in-shell yield averaged 2,224 lbs per acre or 16 percent less using a 4.0 bar below baseline threshold compared to starting irrigation at or near baseline. Cumulative dry in-shell yields in the plots where intermediate thresholds of 1.0, 2.0, and 3.0 bars below baseline were used to trigger the first irrigation were not consistently lower and statistically different from the earliest irrigation start date. Cumulative yields in the 1.0 bar below baseline plots averaged 271 lbs per acre or 2 percent less than the earliest start date. Cumulative yields in the 2.0 and 3.0 bar below baseline averaged 1,126 and 1,460 lbs per acre or 8 and 10 percent lower yields, respectively. While, these yield reductions were not consistent enough to be statistically significant they may be economically important. More seasons are needed to evaluate longer term effects on tree loss, orchard longevity, and consistency of production. If less tree loss occurs over the long term in walnuts when one or more of these intermediate tree stress levels are used to trigger the start

of the irrigation season, the economics could shift to favor a modest delay in the start of irrigation.

A last point from **Table 1 (Page 6)** is the potential to save on water and energy costs by modestly delaying the start of irrigation to one of these intermediate water stress levels. In this experiment, it was possible to reduce irrigation at least 10 percent and possibly more without serious short term impacts on yield. This is worth remembering if faced with water shortages or high pumping costs in the future.

Effect of Crop Water Stress and Irrigation Start Date on Walnut Quality

Table 2 summarizes the effect of early season orchard water stress and irrigation start on walnut quality. The results from all three years have consistently shown that nut weight and nut size can be affected significantly by delaying irrigation too long. In this experiment, crop water stress levels at baseline and as

Continued on Page 10

Table 2. Effect of early season orchard water stress on Chandler walnut quality. Values are averages over all three years.

Tree Stress Just Before First Irrigation (bars below baseline)	Approximate Irrigation Start Date	Nut Weight (grams)	Percent Large Sound	Percent Jumbo and Large	RLI	Percent Mold	Percent Shrivel	Percent Edible Kernel
At or Near Fully Irrigated Baseline[1]	Late April to Early May	10.4 a	79.1 a	77.4 a	54.5	1.3	2.3	45.5
1.0	Mid to Late May	10.1 ab	75.7 ab	73.5 ab	55.1	1.3	2.6	45.7
2.0	Early to Mid June	10.1 ab	75.6 ab	73.5 ab	55.0	1.6	1.8	45.4
3.0	Mid to Late June	9.7 bc	68.3 bc	66.7 bc	54.4	1.8	2.5	45.8
4.0	Late June to Early July	9.3 c	57.7 c	57.7 c	54.7	1.6	2.7	46.1

Photo Credit: Bruce Lampinen

Bronzing of leaves associated with over-irrigation.

Continued from Page 9

much as 2.0 bars below baseline which correspond to irrigation start dates ranging from about 30 to at least 60 days after leafout had no consistent or statistically significant effect on nut weight, percent large sound, or percent jumbo and large walnuts. When irrigation start was delayed more than 75 days to allow crop water stress levels to reach 3.0 and 4.0 bars SWP, nut weight, percent large sound, and percent jumbo and large walnuts were all significantly reduced to levels that could affect price. All other walnut quality characteristics such as kernel color (RLI), mold, shrivel, and percent edible kernel were not affected by early season crop water stress and the decision of when to begin irrigation.

Effects of Delayed Irrigation Start on Deep Soil Moisture

Despite worries that delaying the start of irrigation in the spring would result in depleted moisture leading to more severe stress later in the summer when cutoff for harvest occurs, this has not been the case. The plots that started irrigation

in early to late June were actually less stressed following cutoff of irrigation for harvest than were the treatments that had initiated irrigation in late April and early May in all years of the experiment. This suggests that the trees with delayed spring irrigation may have improved root growth and/or the spring vegetative growth slowed earlier in the season allowing more time for the walnuts to develop and mature and, thus, less stress at harvest.

More in-depth results from this experiment can be found in the report to the California Walnut Board, (http://ucanr.edu/repositoryfiles/2015-115-160270.pdf).

Highlights from the Experiment

Review of this irrigation experiment is not intended to suggest that the start of the irrigation season can be delayed for long periods of time for every walnut orchard. It does indicate that there may be a 30 to 60 day window after leafout to begin irrigation. When optimized, it can protect tree root health from over-irri-

Continued on Page 12

Photo Credit: Bruce Lampinen

Continued from Page 11

gation, avoid too much crop stress from the lack of water, and reduce irrigation water needs and energy costs. Determining how much the first irrigation can be delayed in specific orchard conditions needs to be determined by measuring walnut water stress levels with a pressure chamber or with another reliable indicator of orchard water stress.

Tools to Help Make Irrigation Decisions

A variety of irrigation management tools can help make orchard specific decisions about when to begin the irrigation season. Using at least two of these monitoring tools in combination is encouraged because each tool has limitations.

Starting Irrigation Based on ETc and Rainfall

One approach is to track estimates of evapotranspiration (ET) that reflect current weather and compare it to the amount of spring rainfall received since leafout. The first irrigation is not necessary until the cumulative ET exceeds the amount of spring rainfall received since leafout by at least the amount of water that will be applied in a typical irrigation event (usually 18 to 24 hours of irrigation with pressurized systems). If there is concern about tree loss from root diseases and saturated soils, the first irrigation can be delayed even longer until the difference between cumulative ET and spring rainfall is equivalent to 2 to 4 irrigation events or 36 to 96 hours of irrigation. This approach requires knowing the hourly water application rate of the irrigation system. It can also be problematic in some years because root development and rooting depth can vary depending on winter and spring rainfall and soil temperatures, and this can lead to different levels of early season water stress in walnuts in different years.

Growers in the Sacramento Valley can subscribe online to receive weekly, real-time, regional ET reports during the irrigation season by email at http://www.sacvalleyorchards.com/subscribe/. If assistance is needed contact aefulton@ucanr.edu or dmlightle@ucanr.edu for Tehama, Butte, and Glenn Counties, jkhasey@ucanr.edu for Sutter and Colusa Counties, or kspope@ucanr.edu for Sacramento, Solano and Yolo Counties: Growers in the San Joaquin Valley can request this information from raduncan@ucanr.edu for the northern San Joaquin Valley area; and blsanden@ucanr.edu in Kern County for the southern San Joaquin Valley.

Starting Based on Soil Moisture

There are numerous manufacturers and providers of soil moisture sensing equipment. Some detect volumetric soil moisture content and some measure soil moisture tension. Soil moisture levels can be measured manually or automatically with dataloggers and delivered on demand via cellular and internet services. An important aspect of monitoring soil moisture depletion is placement of the soil sensors to achieve good representation of the root zone and soil variability. The decision to begin the irrigation season can be determined by comparing the amount of soil moisture depletion to the amount of irrigation that will be applied and balancing them. Irrigation should begin before 50 percent

of the plant available soil moisture is depleted in the root zone.

Starting Based upon Orchard Water Status

The pressure chamber and midday stem water has been the state of the art for monitoring tree water stress for some time. Sustained levels approaching 2 bars below the fully irrigated baseline in walnut are a reasonable threshold to begin irrigation. A free on-line UC ANR Publication 8503 describes in detail how to use the pressure chamber to guide water management decisions in walnut.

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

Photo Credit: Bruce Lampinen

Leathery leaves associated with over-irrigation.

Considering New Orchard Replacement Options

Whole Orchard Recycling and Anaerobic Soil Disinfestation

Mohammad Yaghmour
UCCE Orchards Advisor, Kern/Kings Counties

Brent Holtz
UCCE Pomology Farm Advisor, San Joaquin County

Greg Browne
USDA-ARS Davis, CA

With more than a million estimated acres of bearing and non-bearing acres of almonds in California, and tens of thousands of these acres reaching unproductive ages each year, the almond industry is thinking strategically about the process of orchard replacement and how it can best be done, given current and future needs and environmental considerations. The expected lifespan of an almond orchard is approximately 20 to 25 years, and when growers decide it is time for orchard replacement, several management issues come to the forefront.

Among the key orchard replacement challenges is what to do with all the wood from the old trees. Old almond orchards may contain up to 80 tons of woody biomass per acre, depending on tree size and spacing, and burning restrictions and closure of several co-generation plants that previously processed orchard waste has forced some growers to consider new possibilities for dealing with the residues.

Another key challenge in orchard replacement practices is how to manage replant problems. Growers face restrictions on soil fumigation, changes in rootstock usage, and new orchard residue management practices, etc., all of which can affect management of replant problems. Among these problems are Prunus replant disease (PRD), which is a specific soil-borne microbe-induced suppression of early tree growth and yields (affects successive plantings of stone fruits, including almond); plant parasitic nematodes (several damaging species that can reduce orchard productivity over its lifetime); aggressive pathogens such as Phytophthora and Armillaria, which cause crown and root rots; and physical and chemical soil problems related to previous crop production (e.g., compaction, salinity, herbicide residues, etc.).

In this article, we highlight two practices, whole orchard recycling (WOR) and anaerobic soil disinfestation (ASD), as potential elements in new orchard replacement strategies. We consider promising aspects WOR and ASD based on results from trials completed to date and mention newly established WOR and ASD trials. Special reference is made to potential impacts of the WOR and ASD on management of replant problems. Finally, we mention a few of the important contributions being made by fellow researchers, growers, fumigation specialists, and equipment manufacturers in the new trials.

Whole Orchard Recycling (WOR)

WOR has recently gained traction. In the past, most growers would push the trees of removed orchards into piles and burn them. This option became less viable due to increased regulations to improve air quality after the 2002 Clean Air Act. Thereafter, growers started to grind the trees into small wood chips and haul them to co-generation plants to produce energy. In both previous cases, carbon dioxide (CO2) is released into the atmosphere, and CO2 is considered one of the greenhouse gases that contribute

Continued on Page 16

Key Dollar Cab

Protecting Growers Since 1982

Introducing our John Deere 5115ML Orchard Cab

- 100% Stainless Steel Cab Construction
- ½" Orchard Glass Windows
- Powered Dual Stage Charcoal Pressurization System
- The Most Orchard Friendly Shape on the Market

"Celebrating 30 Years of Orchard Cab Innovation"

www.keydollarcab.com (800) 481-0876

Continued from Page 14

to air pollution. The number of acres to be replanted is expected to increase significantly in the coming years, and there are limitations for burning the biomass in orchards or sending it to the co-generation plants.

WOR, the grinding and incorporation of almond biomass back into the soil, is a sustainable alternative to biomass burning that could improve air and soil quality. In 2008, an experiment was established at UC Kearney Agricultural Research and Extension (KARE) Center to compare standard tree removal and burning to whole orchard grinding and incorporation into the soil using the "Iron Wolf," a 100,000-pound rock crusher, that incorporated 30 tons per acre. Almond trees were replanted into the burn and grind treatments in February 2009. Effects of the burn and grind treatments on tree growth and soil physical and chemical properties (e.g., water holding capacity, soil

Table 1. Almond kernel weight (lbs/acre) between grinding and burn treatments

Year	Grind	Burn	Difference
2011	1,007.3 lbs/ac	925.0 lbs/ac	82.3 lbs/ac
2012	1,618.4 lbs/ac	1,533.1 lbs/ac	85.3 lbs/ac
2013	2,100.6 lbs/ac	1,853.1 lbs/ac	247.5 lbs/ac
2014	2,829.5 lbs/ac	2,331.1 lbs/ac	498.4 lbs/ac
2015	1,599.6 lbs/ac	1,427.1 lbs/ac	172.5 lbs/ac
2016	1,603.2 lbs/ac	1,504.6 lbs/ac	98.6 lbs/ac
Total	**10,758.6 lbs/ac**	**9,574 lbs/ac**	**1,184.6 lbs/ac**

organic matter, nitrogen to carbon ratio, and plant nutrients) have been evaluate since that time. Initially, soil analysis revealed significantly higher organic matter, electrical conductivity, cation exchange capacity, and higher carbon, calcium, and sodium in the burn treatment, compared to the grind treatment. It is likely that these responses resulted from the immediate degradation of wood structure that results from burning. However, after six growing seasons, the grinding treatment actually resulted in higher levels of soil organic matter, electrical conductivity, total carbon, and soil nutrients compared to the burn treatment. Also, trees had higher yields in the grind treatment compared to the burn treatment **(Table 1)** and by the 5th leaf in 2013, petiole analysis exhibited significantly higher macro nutrients content (nitrogen, phosphorus, potassium) in the grinding treatment except for magnesium which was significantly lower. In the same way, trees in the grinding treatment accumulated significantly less sodium and more iron and manganese. The early WOR experiments provided an alternative solution to manage generated tree biomass, and this management practice appears to have a positive impact on the environment, that will improve soil physical and chemical qualities available for newly replanted trees. Given the intriguing responses in the initial WOR trial, new trials were designed and established, as previewed below.

Anaerobic soil disinfestation (ASD)

Although new to perennial crop systems, anaerobic soil disinfestation (ASD) has been researched and used commercially in annual cropping systems in Japan, The Netherlands, and the U.S. ASD is now being adapted for strawberry production in California and vegetable and floriculture systems in the southeastern U.S. In annual cropping systems, ASD generally has provided broad-spectrum control of many soilborne pathogens in diverse soils, but less is known about its effectiveness for orchard crops.

Researchers have found that ASD mechanisms may be multiple and complex, including the generation of organic acids, metal ions, volatiles, and microbial population shifts that are lethal or suppressive to soil pests. ASD is implemented for several weeks and requires readily available carbon substrate(s), moist soil conditions, and coverage with plastic mulch, which raises soil temperature, retains moisture, and retards gas exchange. High soil temperatures favor ASD while low temperatures limit it.

In four previous trials conducted at KARE during 2013-2016, we found that ASD was as effective as preplant strip fumigation with Telone C35 in controlling PRD and stimulating tree growth **(Figure 1)** and yield. Damaging plant parasitic nematodes were not present in the initial four ASD trials at KARE. Given the technical efficacy of

Continued on Page 18

Photo Credit: Mohammad Yaghmour, Brent Holtz and Greg Browne

Figure 1. Responses of trees to preplant treatments in one of the initial ASD trials at the UC Kearney Research and Extension Center. Foreground, stunted trees exhibiting PRD in a non-fumigated control plot; left and right backgrounds, vigorously growing trees in preplant fumigated and preplant ASD plots, respectively.

Photo Credit: Mohammad Yaghmour, Brent Holtz and Greg Browne

Figure 2. Dr. Greg Browne inspecting wood chips spread on the soil surface at approximately the same rate the trees were removed (65 tons per acre).

Figure 3. Anaerobic soil disinfestation substrate (ground almond hull and shell) spread on soil surface as a treatment of a total of four treatments applied to wood chip and no-chip plots.

Continued from Page 17

ASD in these "first generation trials", we established "second generation" trials to optimize the ASD carbon sources and application methods and test ASD with nematodes as well as with PRD, as previewed below.

New Replant Trials Testing WOR and ASD

Currently, there are six WOR replant trials throughout major almond producing regions in California to refine the life cycle assessment model for evaluation of carbon dynamics and balance, as well to examine effects of WOR on soil physical, chemical, and biological properties and their impact on replanted trees growth and health. Also, six new ASD trials were established in the San Joaquin Valley in 2016 to examine economical ASD carbon sources, test streamlined ASD application procedures, and test the practice in soil where PRD and nematodes are both present as replant problems. Amelie Gaudin, Plant Sciences UC Davis; Andreas Westphal, Nematology UC Riverside; and others have joined our efforts in WOR and ASD testing.

Among the new trials, four of the most extensive ones were established at two orchard replant sites in Kern County in collaboration with Wonderful Orchards. Both sites are expected to express PRD, and one of them harbors damaging plant parasitic nematodes. In two of the four trials (one at each orchard), the main treatments are wood chips vs. no-chips. Wood chips were placed back on the soil surface at the same rate the trees were removed with approximately 39 and 65 tons per acre in the first and second site respectively **(Figure 2)**. Embedded in each replicate wood chip and no-chip plot, there were four additional subplot treatments: 1) a non-fumigated control, 2) spot fumigation with Telone C35, 3) strip fumigation with Telone C35, and 4) ASD using ground almond hulls and shells as a substrate and carbon source **(Figure 3)**. Wood chips and ASD material were incorporated in the soil using a stubble disk. However, using a disk to incorporate a

Continued on Page 20

Photo Credit: Mohammad Yaghmour, Brent Holtz and Greg Browne

Figure 4. Incorporation of wood chips and ASD substrate (ground almond hull and shell) into the soil using a Northwest Tiller rototiller.

Continued from Page 18

high rate of wood chips at the second site was a challenge. Wood chips and ASD materials were successfully incorporated into the soil using a rotiller from Northwest Tillers **(Figure 4, Page 19)**. ASD treatments received irrigation water through drip lines covered with totally impermeable film (TIF) tarp **(Figure 5)**. In the other two trials (one at each orchard) treatments were assigned to test the importance of each ASD component, i.e., carbon substrate, tarp, and soil moisture. Rice bran was used as the carbon source in the additional ASD trials, and, for comparison, treatments of a non-treated control, spot-fumigation, and strip fumigation (Telone C35) were included.

Finally, each of the four new WOR and ASD trials in Kern County are being replanted in a manner to test the response of two key rootstocks, Hansen 536 (peach x almond hybrid) and Nemaguard peach. Peach x almond and additional hybrids have become popular rootstock choices in the San Joaquin Valley, and it is important to learn more about their response to PRD and plant parasitic nematodes in WOR and ASD contexts, with and without soil fumigation. Our trials will address some key rootstock questions that surface in relation to WOR, ASD, and management of almond replant problems.

The efforts in executing the trials in Kern County would not have been possible without the collaboration and generous contributions of Wonderful Orchards, TriCal, Inc., the Almond Board of California, the California Department of Food and Agriculture, and the California Department of Pesticide Regulation. We would also like to thank Northwest Tillers for their kind incorporation of WOR residues in one of the Kern County trials.

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

Photo Credit: Mohammad Yaghmour, Brent Holtz and Greg Browne

Figure 5. Anaerobic soil disinfestation plot after installing drip lines and placing TIF tarp.

GROSSI FABRICATION INC.

Grossi Fabrication is an industry leader in designing and building highly efficient processing systems for the almond and walnut industries.

Our unrelenting focus on improving efficiency has led to breakthrough innovations in precleaning, hulling, drying and shelling technology, as well as significant improvement in presorting, conveying, cleaning and storing almonds and walnuts.

We design and build 95% of the equipment we sell right here in California and have built our company and reputation one satisfied customer at a time. Give us a call and let Grossi Fabrication show you how the right processing system can transform your business.

PRECLEANING | HULLING | DRYING | SHELLING | PACKAGING

3200 TULLY ROAD, HUGHSON, CA 95326 | 209.883.2817 | WWW.GROSSIFAB.COM

Developing New Pistachio Orchards from Training to Fertilization

Cecilia Parsons
Contributing Writer

Coming off a harvest with two percent navel orangeworm damage, USDA-ARS researcher Joel Siegel has an ominous prediction for the 2017 pistachio crop: 'It's going to be a challenge."

Winter rains and cold usually mean a higher mortality for overwintering navel orangeworm (NOW) in mummies on the ground, he said, but NOW in the mummies left on the trees do not have the same fate- meaning a high survival rate of NOW in the tree mummies likely negates the higher mortality of mummies on the ground.

The two percent NOW damage to the 2016 pistachio crop was unexpected by the industry and took a lot of growers by surprise, Siegel said. For some it was the worst NOW damage experienced.

With few exceptions, the tools growers have to control NOW in their pistachio orchards remain largely the same this year, and preventing high NOW damage in 2017 will be a challenge to growers.

Sanitation

- Floor Management
- Mummy Removal from Tree Rows
- Complete Destruction of Mummies

Good orchard sanitation remains the cornerstone of NOW control in pistachios as high overwinter survival will lead to more nut damage. One female NOW that survives can produce 85-100 eggs in the spring.

Justin Nay, pest control advisor with Integral Ag said he is taking the "hard floor" approach to sanitation and abandoning disking middles. Nay said having hard, smoother orchard floors will improve sanitation by making it easier to blow and sweep mummies from away from tree rows and into middles where they can be destroyed by flail mowing. Best scenario, Nay said, is to reduce numbers to 10-20 mummies per tree, making it easier to manage overwintering populations. It is common in many orchards to have much higher numbers- 2,000 to 3,000 per tree - and with that kind of build up of population, control is much more difficult.

Nay said the current wet conditions in many pistachio orchards may be drowning NOW in mummy nuts, but there is no hard data to support the theory. Wet and muddy floors also mean more mummy nuts are ground into the dirt but not destroyed.

Orchard sanitation practices in pistachio production have improved in

recent years, said Brad Higbee, Field research and development manager for Trece Inc. a company that specializes in insect monitoring and pheromones. Field trials have shown that NOW damage is lower with orchard sanitation and mowing and shredding floors is more effective sanitation that disking. Reducing both tree and ground mummies is proven to lower NOW damage, Higbee said.

Because of the high mobility of NOW, he advised managers of neighboring blocks of pistachios to work together on sanitation.

There are machines in the research phase that are being engineered to pulverize pistachio mummies, Higbee confirmed.

Mating Disruption

- Increases Performance of Chemical Controls, Sanitation
- Resistance not an Issue
- Environmental Stewardship

More pistachio growers are using mating disruption in their orchards to supplement sanitation and chemical control.

Mating disruption is most effective when added to existing insecticide programs, Higbee said. It is the best fit when current insecticide programs are not reducing NOW damage sufficiently or more than four insecticide applications are needed for control.

Mating disruption (MD), dispensing a pheromone in the orchard to confuse male NOW and reduce mating activity has added benefits in pistachio production. There are no resistance issues with the pheromone, the economics of MD have become more favorable in recent years and MD places environmental stewardship in the marketing portfolio.

Most MD is done with aerosol puffers, placed in trees at a recommended rate of two per acre. There is also a passive dispensing system that is expected to be on the market in the future. Only a small amount of the pheromone is needed in pistachio MD, Higbee said, but unfortunately it is very expensive to formulate. Depending on the product used, costs for mating disruption can run $120 to $160 per acre.

In a presentation at the annual

Continued on Page 24

Continued from Page 23

Pistachio Day event in Visalia, Higbee showed results of trials from 2012 to 2015 that showed the effect of improved orchard sanitation plus mating disruption on NOW damage percent. The combination consistently lowered damage by 50 percent compared to control blocks. In addition, year to year percentages were lowered across all blocks.

Chemical Control

- Move to Ovi Larvicide
- Adequate Coverage Difficult to Acheive
- Loss of Effective Pesticide

Pistachio growers relied heavily on organophosphates for control of NOW before transitioning to pyrethroids. Increasing resistance and regulatory issues are now leading to transition to ovi larvicide products. Those products can be effective, but adequate coverage is a problem.

Residues need to be where the eggs are laid, Higbee said, and that has been difficult to achieve no matter which delivery system is used due to shadowing and angle of tree branches. Trials comparing different spray methods found no significant differences. The standard ground application at two miles per hour is still the standard, he said, but above 12 feet there is a severe drop off in coverage and residue deposition. PTO based machines are as effective as engine drive and large arrays of "cone jet" nozzles did not provide any significant advantage at 2 mph, but they may have potential at higher speeds. Higher spray towers do not perform significantly better. Helicopter application in combination with ground did achieve better residues high in the tree, but that did not result in nut damage reduction relative to the standard ground application.

Best strategies for chemical control include residue loading prior to the first shake. The later the spray, Higbee said, the greater the impact. Late July to early September are prime time for applications.

Pyrethroid tank mixes have the most impact, but Higbee warned that use in pistachios is now on the radar of EPA and currently under review.

Monitoring

- Pheromone Traps, Lures
- Accuracy of Trap Data
- Consistency

Pheromone traps are used to monitor the flights of adult male NOW. The synthetic lures are placed in large delta or wing traps and hung in pistachio orchards beginning in mid March. Other monitoring tools are degree day calculations and egg traps.

Degree days or egg traps are most effective in determining the first NOW flight. Egg traps determine NOW egg laying activity but have diminished attraction to NOW later in the season. By the second flight, synthetic lures will provide better surveillance of NOW populations.

Higbee advised picking a trap and lure combination and sticking with it to compare year to year data and locations.

There are some automated traps being tested, Higbee said, but downloading data can be a challenge in areas that lack reliable cell signals.

The Future

There are some new technologies in the future for NOW management in pistachio. Sterile insect programs have been successful in eradication of other insect pests, most notably pink bollworm. Pistachio industry leaders are is looking at these programs, Higbee said, but the need for millions of sterile NOW moths to be produced for just one week will be a challenge.

Gene manipulation, Clustered Interspersed Short Palindromic Repeats (CRSPR) could be powerful tool in NOW management, Higbee told growers. This technology is different from genetic modification in that it does not introduce DNA, but manipulates or silences key genes.

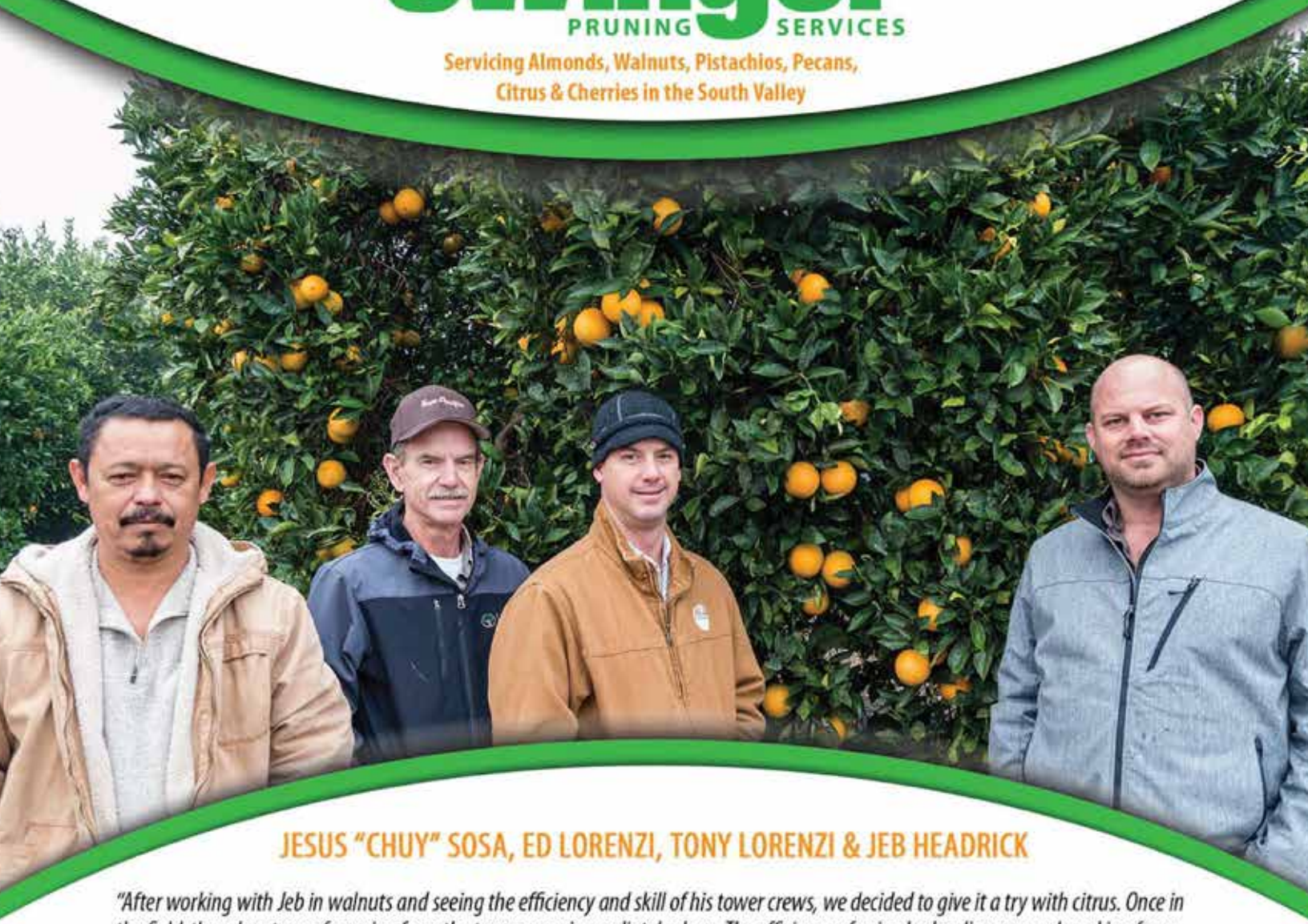
"I was hoping this was something that would be available soon, but was told this is 5-10 years away" Higbee said.

"For now we need to make the best use of the tools we have."

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

Swinger℠
PRUNING SERVICES

Servicing Almonds, Walnuts, Pistachios, Pecans,
Citrus & Cherries in the South Valley



JESUS "CHUY" SOSA, ED LORENZI, TONY LORENZI & JEB HEADRICK

"After working with Jeb in walnuts and seeing the efficiency and skill of his tower crews, we decided to give it a try with citrus. Once in the field, the advantage of pruning from the towers was immediately clear. The efficiency of using hydraulic saws and working from the outside and above the trees gives the pruner a distinct advantage. My concerns about possible lack of experience in citrus were quickly dispelled by the obvious skill of his foreman Chuy. His understanding of shading and the importance of light penetration were what we were looking for.

I do not know of a more efficient way to do the job we are trying to do. We plan on expanding our use of tower pruning in the upcoming season. Tower pruning will allow us to effectively thin out the heavy brush in the shoulders of the trees, an area where it has always been difficult to get good spray coverage. This is even more important with the growing threat of red scale."

- Tony Lorenzi, Sun Pacific

Swinger Pruning Services | **Jeb Headrick (Owner)** (559) 816-7711 | **20 Years of Experience**

Introducing Gumdrop

UC's Newest Pistachio Cultivar Release

Photo Credit: Craig Kallsen

Gumdrop, pictured, was released female pistachio cultivar from the University of California Breeding Program in July of 2016.

Julie R. Johnson
Contributing Writer

For the pistachio grower one of the key components of success is harvesting a crop with the ability to get it to a processor in a timely manner. This critical issue has led researchers in the field to develop pistachio varieties that can be harvested at unique times relative to other varieties. With this in mind, "Gumdrop" was released female pistachio cultivar from the University of California Breeding Program in July of 2016.

Craig Kallsen, UC ANR CE Farm Advisor, Kern County, and associates, discussed the Gumdrop variety during the 2017 State Pistachio Day in January in his presentation, "Tips on choosing and producing pistachios with U.C. cultivars."

He explained Gumdrop got its name due to its tendency to produce a tiny drop of gum on some of the nut hulls as harvest approaches, making it "stickier" at harvest that Kerman, Golden Hills or Lost Hills.

"There is no such thing as a perfect variety," Kallsen said. "With Gumdrop, what is unique is its early harvest. Gumdrop is going to harvest way before the later harvesting Kerman, at least 24 days earlier."

Since most of the existing crop, predominantly Kerman, matures about the same time, difficulty has arisen for growers in finding both harvesting equipment and people to run them at harvest time. In addition, the common harvest time overly inundates the pistachio processing facilities in the state which numbers are lacking in comparison to the growing number of pistachio-bearing trees.

Gumdrop blooms about five days before Golden Hills and 10-11 days before Kerman. It matures about 12 days before Golden Hills and, as stated, about 24 before Kerman. Its harvest is about 10-12 days before Golden Hills.

Having a maturity series within the

industry, such as the sequence of Gumdrop, Golden Hills and Kerman, over nearly a month in the fall harvest season, helps to eliminate the harvest and processing problems within the industry.

Another potential advantage of Gumdrop, because it blooms early, is that it may have a lesser chilling requirement, Kallsen said.

"Compared to other varieties, Gumdrop has shown the least amount of impact from low chill years, such as delayed bloom, extended bloom, flagging of shoots, early nutlet drop and poor yield," he explained.

This may be a very important characteristic in the future with respect to the warming climate, according to researchers.

Low chill years have presented great difficulties for pistachio growers in lower sections of the state during periods when chilling was well below the minimum needed for varieties such as Kerman.

Introducing two new released male pollinators, Famoso and Tejon, Kallsen said "it is hard to go with just one male pollinizer anymore with the low chill we have been experiencing."

"The females tend to be more consistent and the bloom of the male seems to walk around that," he added. "For Gumdrop, the primary male is Tejon because Gumdrop blooms fairly early compared to Lost Hills, Golden Hills and Kalehgouchi, maybe as much as four to five days earlier at full bloom.

"We don't have a UC early male for Gumdrop at this time. I think we need something there."

Kallsen said there is some budwood "out there" earlier than Tejon that dates back to some Aria variety blocks that could work as an early male. He advised growers to give him a call for more information concerning this possibility (Craig Kallsen, office phone 661-868-6221; cekallsen@ucdavis.edu).

In addition, Gumdrop's early bloom makes is less susceptible to insect damage, such as the Navel Orangeworm (NOW), Kallsen explained.

Experience with Golden Hills has shown that earlier harvest limits exposure of the crop to the last NOW flight, thereby limiting potential aflatoxin contamination and crop loss issues.

Compared to Kerman and Golden

Continued on Page 28

Photo Credit: Craig Kallsen

Gumdrop pistachio trees are pictured on the left with Golden Hills on the right.

Photo Credit: Craig Kallsen

Gumdrop pistachio comes into full bloom earlier than Golden Hills, Lost Hills, Kalehghouchi and Kerman.

Continued from Page 27

Hills, the yield of Gumdrop has been very similar, according to trials.

However, researchers believe the very early harvest date of Gumdrop allows for the potential of higher yield in future low-chill years, compared to some existing cultivars.

"A timely and early harvest is essential for adequate nut quality with Gumdrop," Kallsen added.

Statistics show Gumdrop with some insect damage and dark stained shells at harvest, but Kallsen believes this is due to harvest being delayed a week or more after nut maturity because the commercial nut processors were not yet open to accept pistachios for processing.

"This delay at this time of year undoubtedly increased insect damage and staining in this cultivar. We have had to store them on the trees and we are looking at ways to avoid that, but the processors are just not open at the point Gumdrop is ready for harvest," he explained.

Kallsen said this is a caution on growing the newly released Gumdrop. "To date, processing and hulling facilities have not been open where Gumdrop has been ready for harvest. Do not plant Gumdrop unless you know that a processing plant will be open to take the crop when it is ready for harvest," he advised. "You don't want to store the crop on the tree during the heat of August because hulls will start to tatter, plus the threat of Navel Orangeworm and stain."

Gumdrop nuts size is about the same at Kerman and Golden Hills, with a medium shell hinge strength that is stronger than Lost Hills, but weaker than Kerman or Golden Hills.

"Weaker shell hinge strength means more kernels are lost in hulling, but the nuts that survive hulling are easier for consumers to open," Kallsen said.
Nut characteristics of Gumdrop include a very high split percentage, similar to Golden Hills, the "gold standard" for split, and significantly better than Kerman, records show.

Researchers have found cultivars that split well are desired by growers since they receive substantially higher payment for naturally split nuts.

However, Gumdrop is about the same as Kerman in the area of early split, which can be associated with increased

Average full bloom dates for Gumbrop, Tejon, Golden Hills, Randy, Kerman and Peters at the Buttonwillow Trial 2012-2016			
Cultivar	Sex	Avg. full-bloom date	Avg. full bloom date - days from Kerman
Gumdrop	Female	Mar. 27	-10
Tejon	Male	Mar. 28	-9
Golden Hills	Female	Apr. 1	-5
Randy	Male	Apr. 4	-2
Kerman	Female	Apr. 6	------
Peters	Male	Apr. 10	+4

NOW damage, Kallsen said.

"Gumdrop may require more than one shake at harvest as it somewhat lacks in uniformity of nut maturation across the tree," he stated. "Probably related to its long bloom variability."

Kallsen advised growers to be sure and not slow down irrigation too early at harvest on the early producers or they run the risk of drying out the crop, and to be sure and put the irrigation right back on after harvest.

"With Gumdrop, don't delay harvest until the hulls have tattered. The hull of Gumdrop nuts do not tatter as much as Kerman when ready for harvest," he added. "Once the majority of nuts split, harvest can begin. The nuts will be split and ready for harvest even if the hulls remain intact, in fact, intact hulls at harvest may reduce infestation by Navel Orangeworm compared to Kerman and

Continued on Page 32

AMAZING COVERAGE BETTER YIELDS & QUALITY

NELSON

The **NELSON HARDIE® Super 80** engine drive sprayer, with twin 40 inch diameter fans, provide exceptional coverage for a wide variety of trees such as almonds, walnuts, pecans and crops with heavy foliage such as citrus.

- Twin 40" Dia. HD Fans
- 175 & 225 HP JD Diesel
- Stainless Steel Hood/Doors
- 500-1000 Gal. S/S Tank
- HD Galvanized Frame

CALL FOR A DEALER NEAR YOU!

QUICK & EASY OPERATION PRUNE YOUR ORCHARD FASTER

NELSON

Smooth action Nelson **TREE SQUIRREL®** pruning & picking towers are designed for productivity. Conveniently located controls and tools are easy to use. Efficiency is further enhanced with 2 ground speeds (standard). Frame design provides excellent stability and maneuverability.

- 20' and 25' Models
- Smooth Action
- 2-Speed Drive
- 25HP Kubota Diesel
- Powdercoat Finish

CALL FOR A DEALER NEAR YOU!

NELSON MFG. CO., INC. • 2860 COLUSA HIGHWAY, YUBA CITY CA 95993 • 530-673-0919 • NELSONHARDIE.COM

THE BEST... JUST GOT BETTER

ALL NEW ORCHARDCAB. DESIGN FOR JOHN DEERE!

- More insulation keeps cab quieter and cooler
- Controls relocated for ease of operation
- Smoother frame and "Crop-friendly" shape
- Better visibility all around
- Certified ROPS with two entry/exit Doors
- 1/2" tempered Hehr glass available

NELSON

ASK FOR NELSON ORCHARDCAB.

NELSON MFG. CO., INC. YUBA CITY, CA • (530) 673-0919

INFO@NELSONHARDIE.COM | WWW.NELSONHARDIE.COM

Photo Credit: Craig Kallsen

Gumdrop variety pistachio nuts compared to Kerman and Golden Hills.

Continued from Page 29

Lost Hills."

Gumdrop is a fairly fast growing tree, faster than Golden Hills or Kerman on seedling UCB-1 rootstock.

A concern for Kallsen, is variety overgrowth—Gumdrop growing faster than its rootstock.

"Although, the trees still seem to do okay," he said.

The growing nature of the Gumdrop is not as upright as Golden Hills or Lost Hills and it has thick branches, he said.

"We have a learning curve on how to train this variety," Kallsen explained.

According to Kallsen, the purpose of his presentation was not to determine which is the best pistachio cultivar in California, but to present comparative information on strengths and weaknesses of such varieties as the newly introduced Gumdrop.

"This information should assist growers in determining, which might be most suitable of five varieties for their individual farming and marketing conditions," he said.

Gumdrop budwood has been released to U.C. licensed growers, budders and nurseryman.

"Only licensed people are allowed to produce Gumdrop budwood," Kallsen added. "Since budwood was released recently, it will be a few years before sufficient budwood is available to establish orchards."

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

Helping Farmers Grow NATURALLY since 1974

COMPOST

COMPOSTED DAIRY MANURE 1.25-1.50-2.5 QUALITY GUARANTEED

- Stable and nutrient rich source of organic matter
- Pathogen Free
- Weed Free
- Rich in Micro-organisms

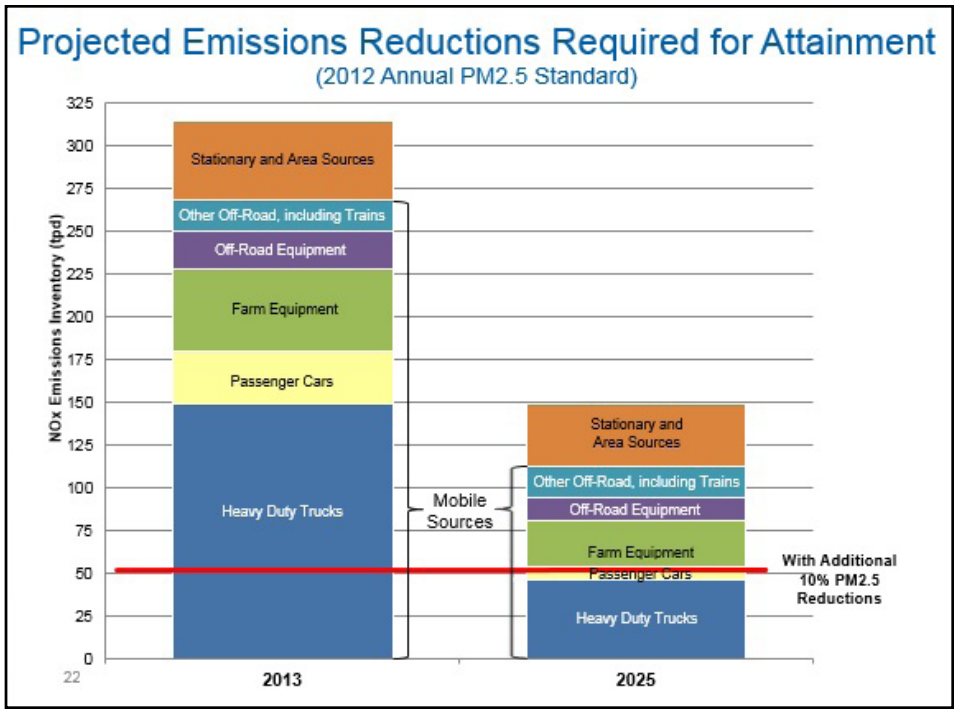
NEW ERA FARM SERVICE

www.neweraafarmservice.com

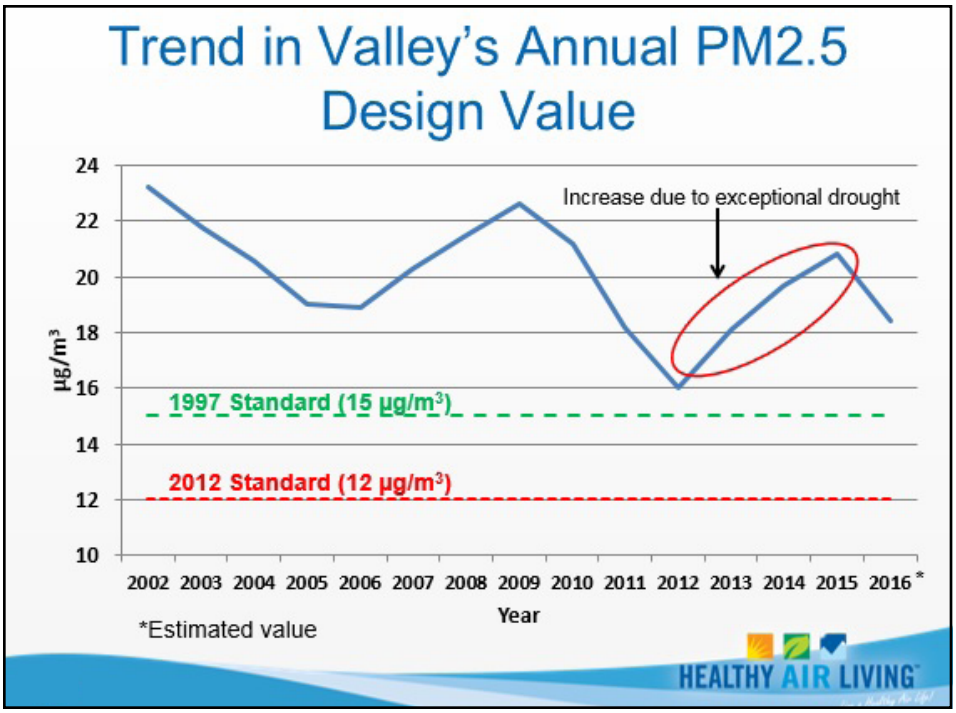
Doug Graham, Certified Crop Advisor, *License #329563*
Cell: 559-903-6007 Phone: 559-686-3833 Fax: 559-686-1453
2904 E. Oakdale Ave. | Tulare, CA 93274
doug@neweraafarmservice.com

The Next $PM_{2.5}$ Plan is Under Development and Agriculture is a Target

Roger Isom
President/CEO, WAPA



What in the world is $PM_{2.5}$? And as a tree nut grower, huller, processor or anyone involved in the tree nut industry, why should I care? Because the San Joaquin Valley Air Pollution Control District (SJVAPCD) and the California Air Resources Board (CARB) are working on a new State Implementation Plan (SIP) intended to reduce $PM_{2.5}$ emissions by adopting strict control measures, some of which could be mandated statewide or set significant precedents for other air districts. To understand this, one needs to first understand $PM_{2.5}$ and what it is. $PM_{2.5}$ is particulate matter in the air that is of a size of 2.5 microns or less, in other words, very, very small! Typically, you would find $PM_{2.5}$ in the form of smoke or soot, but it also is found in the form of ammonium nitrate or ammonium sulfate, which are secondary particulates formed by the presence of ammonia in the air. It can also be found to a much lesser extent in some sources of dust or geologic material. Federal EPA sets an "ambient air quality standard" for how much of a certain pollutant, in this case $PM_{2.5}$, that can be in the air to be considered "in attainment" of the standard. In California, there are some areas that are in "non-attainment" of the $PM_{2.5}$ standard including the San Joaquin Valley, Imperial County, Los Angeles, and Plumas County.



Now that we know what it is, why should we be concerned? Because the federal Environmental Protection Agency (EPA) has set forth very low standards for $PM_{2.5}$ that will be difficult, if not impossible, to achieve. The first $PM_{2.5}$ standard established both an annual average standard and a 24 hour standard. The Annual average standard was set at 15 micrograms/m3, and the 24 hour standard was set at 65 micrograms/m3. Then in 2006, Federal EPA lowered the 24 hour standard to 35 micrograms/m3. And in 2012, Federal EPA lowered the annual average to 12 micrograms/m3. These new standards will be very tough, if not impossible, to achieve. According

WalnutTek Advantages
- Walnut sorting at the huller, and in-shell
- Green and black re-sorting at the huller
- Several width options — 32, 48, 64 or 80in
- Capacity from 5-30 tons/hour

Automated Moisture Monitoring at the Dryer

All moisture meters are available for use individually or in conjunction with the WalnutTek sorter.
- Hand-held moisture meter
- Automated moisture meter
- Automated moisture meter with door control
- Automated moisture meter with door control and bin fill

AgTrack
- Traceability from the farm-to-processor

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

to the SJVAPCD and CARB, major reductions in $PM_{2.5}$ emissions will be needed to achieve attainment (see emissions chart, page 34). In fact, they claim the emissions from combustion sources, particularly mobile sources, in the state would have to be cut in more than half to come close to achieving the $PM_{2.5}$ standard and that's after full implementation of the existing CARB Truck Rule! There have been several workshops and planning meetings that have already occurred, and this is what we know at this point. Agriculture is being looked at for additional emission reductions from the following categories:

- Ag Tractor Rule – replace ag tractors and harvesters (particularly almond harvesting equipment) for both NOx and $PM_{2.5}$ reductions
- More stringent engine standards for agricultural pump engines (beyond tier 4 and cleaner natural gas engines)
- A new low-NOx standard for heavy-duty diesel trucks (beyond ARB's current Truck Rule)
- Alternatives for ag burning
- Additional Conservation Management Practices (CMPs) to reduce fugitive dust
- Additional restrictions under Regulation VIII for fugitive dust

The Western Agricultural Processors Association has been present at every workshop and meeting to ensure that agriculture, particularly the tree nut industry has a voice in the development of this plan. Represented by President/CEO Roger A. Isom and Director of Technical Services Christopher McGlothlin, the Association has testified at the meetings stating that incentives are absolutely critical and necessary for the agricultural community due to their inability to pass along the additional costs. Isom further commented that USDA NRCS already had a program to incentivize the low emission nut harvesting equipment and that the Association is working to develop a similar program with the Air District. In addition, the Association also pointed to significant research performed recently to more accurately determine $PM_{2.5}$ emissions from agricultural operations and that data showed that $PM_{2.5}$ emissions from almond harvesting equipment, cotton gins and other operations are insignificant. While the arguments are solid, there is intense pressure on the Air District and CARB to adopt some of these measures. Environmental activist groups are in full force pressing the SJVAPCD and CARB to do more. The plan must be adopted by the District sometime late this summer, but CARB will be moving forward on a portion of these at their monthly meeting in March. If you haven't been following this issue, be sure to add it to the myriad of issues bearing down on California agriculture.

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

Options for Gopher Management

Dani Lightle
UCCE Orchards Advisor, Glenn, Butte & Tehama Counties

"The Gophers, though in size the smallest of our enemies, seemed for a while the most difficult to overcome…They kept their ground; and beets, carrots, lettuces and cabbages were carried off triumphantly by those original occupants of the soil, who doubtless looked upon us as intruders…We did not take the same moral view of the subject. We did not argue morally at all. They were our enemies, and we concluded to exterminate them."

- William Thompson, (aka 'Agricola'), The California Farmer, 1858

When it comes to gophers, little has changed in 160 years; they remain a difficult pest to manage and I meet few growers harboring residual guilt over their gopher kills.

A bad gopher infestation can reach populations as high as 30-40 per acre. A typical gopher mound **(Photo 1)** is crescent shaped with a round plug on one side of the mound; they can be distinguished from mole mounds which are fully circular and the plug is in the center. In orchards, the risk is to the roots and especially crown of the tree. Feeding on the bark around the crown girdles the tree, leading to tree collapse or death. Trees are at greatest risk for damage when their preferred food sources of weeds or cover crops dry up and they require another food source. Gophers also gnaw on subsurface drip and plastic irrigation lines which leads to decreased distribution uniformity and irrigation problems.

If you have trees declining and you suspect gopher damage, dig carefully away around the crown of the tree. Look for gnawing and tooth marks, accompanied by missing bark—a severely affected tree can be girdled the entire way around the trunk **(Photo 2)**. The pattern

Continued on Page 38

Photo Credit: Jack Kelly Clark

Photo 1. Gopher mounding with characteristic crescent shape on the right side.

Photo Credit: Jack Kelly Clark

Photo 2. Bark removed from the crown of an almond tree as a result of gopher feeding. The gopher tunnel can be seen just to the right of the trunk.

Stick Jack

Preharvester De-Sticker/Conditioner

Remove sticks, reduce labor and increase harvester performance in a single pass.

- Eliminate sticks in a single pass.
- Unload sticks with a flip of a switch.
- Adjustable ground clearance.
- Rotating sweeper brushes for even windrows.
- Increased harvesting productivity.

Built for Speed... Born to Run

471 Industrial Ave. • Ripon, CA 95366 209.599.6118 • www.jackrabbit.bz

Speed • Reliability • Innovation

Continued from Page 36

of affected trees may vary. I have seen some orchards where gophers moved down the row, feeding on one tree after the next; in other orchards, the affected trees are more randomly distributed.

If your orchard had a fair amount of standing water from rain over the last couple months, gophers may have experienced greater winter mortality than usual through drowning or predation while in search of higher ground or berms. Note, however, that the abundance of resident vegetation growing in response to the rains may offset winter mortality with a reproductive pulse and population bounce. Now is a fantastic time to control gophers while populations are lower, and before the reproductive pulse occurs in the March-May time frame. If rain continues throughout the month, the best time to look for fresh mounding activity for implementing control measures is approximately 48-72 hours after rainfall.

"We despised the Gophers; we would have them rooted out; and to accomplish this object no proposal was thought too base to be adopted. Some said trap them; some said poison them; some said drown them out; some said smoke them out. We differed as to the means, but we all agreed in keeping no terms with the humble Gophers."

-William Thompson, (aka 'Agricola'), The California Farmer, 1858

Though some of the details have changed, we essentially have the same tools for gopher control now as in 1858. I'll briefly run though some methods that don't work and that you would do well to avoid, and then focus on some of the strategies that have better efficacy.

First, the methods that *don't* work:

- Exclusion fencing around the perimeter of the orchard. A logistical nightmare, it's also expensive and provides minimal benefits over so large an area.
- Gas cartridges and smoke bombs. These methods don't work because of the complexity of the burrow system, gasses leaking out through porous soils, and the gopher behavior itself – they will physically plug off the burrow when they detect something is amiss. *Exceptions:* Aluminum phosphide tablets and carbon monoxide generators (more on these below).
- Sounds, vibrations, and electromagnetic devices. These techniques may be slightly efficacious in the short term, but gophers burrow next to active train tracks. Clearly, the noise and vibrations are not a deterrent in the long run.

Methods that *may* help:

- Reliance on predators (owls, herons, snakes etc.). Predators can control populations if you have appropriate predator habitat available, as well as a relatively high tolerance to gopher populations. Research into use of barn owls is ongoing.
- Flood irrigation. If you are relying on flood irrigation, a subset of gophers may drown or decide to move out of the orchard.

Photo Credit: Jack Kelly Clark

Photo 3. Modified Macabee trap with greater efficacy against larger individuals.

Most efficacious control methods:

Trapping is labor intensive, though the labor costs may be offset by the high efficacy (greater than 90% after a couple sessions). Commonly used traps include the Macabee, Cinch, and Gophinator (pincer-type traps). Of traps tested by Baldwin et. al. in 2013, the Gophinator was the most effective, in part because it trapped larger individuals best. For the handy grower with a stash of Macabee traps hanging around,

the trap can be modified by adding a 9" cable (0.06" diameter) to the front of the trap **(see Photo 3)**, which increases catch rate of larger individuals. A newer trap to the market is the Gopherhawk. It is much more expensive, but anecdotal evidence from growers is positive; however, it has not been tested alongside other trap types in independent UC research trials.

To use pincer-type traps (e.g. Gophinator), find a fresh mound and use a probe to find a main tunnel running parallel to the ground surface. Tunnels are generally about 6-8" below the surface. When you find a tunnel, resistance to the probe will decrease and the probe will drop quickly a couple inches. Dig carefully down to the main tunnel and place two traps, one facing in each direction **(see Photo 4)**. You can cover the hole, though it doesn't increase trapping efficacy except at hot temperatures and it substantially increases the amount of labor time involved. Human scent doesn't appear to have an impact, so gloves are not necessary, and attractants such as peanut butter only seem to help if your trap set is covered. Traps

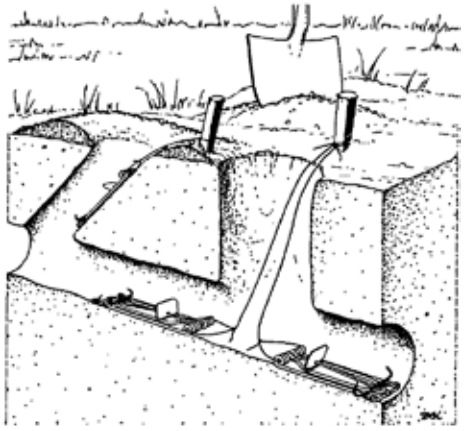


Photo 4. Diagram of gopher tunnels showing placement of gopher traps. Two traps set in opposite directions in the main tunnel is a better trap set. The lateral tunnel trap (on left) is easier to set up but has less productive trap capture. From: Marsh, 1998, Proceedings of the Eighteenth Vertebrate Pest Conference.

can also be placed in the lateral tunnels that run up to the fresh mounds; while they are easier to set, they are also not as effective **(Photo 4)**.

Aluminum phosphide and carbon monoxide generating machines are two fumigant options for gopher control. Aluminum phosphide is a restricted use material and a permit is required for application. After probing near active mounds to find a tunnel, the tablets or pellets are dropped into the tunnel and the tunnel sealed with a rock or soil. The key for efficacious aluminum phosphide use is appropriate soil moisture. At tunnel depth (6-8"), the soil should be moist enough to maintain a ball in your hand. If the ball falls apart, the soil is too dry and the treatment will not be effective.

Carbon monoxide machines are the least effective and most expensive of all the methods I'm describing in this article (approximately 60% effective), but may have a role if growers have large acreage to treat or if baits and aluminum phosphide become further restricted. Currently, the most effective option is the PERC machine, which forces pressurized carbon monoxide into the burrow system and asphyxiates the gophers.

There are two types of baits avail-

Continued on Page 40

Continued from Page 39

able for gopher control. Acute toxicants (such as strychnine and zinc phosphide) kill after a single feeding; anticoagulants (such as chlorophacinone or diphacinone) require multiple feedings over 3-5 days before having a lethal effect.

Widely recognized as the most effective, strychnine is now typically available only as a 0.5% formulation, and is difficult if not impossible to obtain. If you do have access to strychnine bait, recognize that gophers can develop behavioral avoidance to the bait over time, so other methods may need to be employed as well. Zinc phosphide is more readily available, but gophers will frequently avoid it because of its distinct smell and taste. Anticoagulants require a larger amount of bait (10 times the amount of strychnine bait) to be placed because gophers must feed multiple times; this increases the costs of treatment.

Baits are applied in the main tunnels, and several baiting tools/methods are available. The basic protocol is to find active (fresh) gopher mounds, probe to locate the main tunnel between two mounds (as described above), drop the bait into the tunnel, then cover the probe hole with a rock or soil. Plan on baiting the burrows again if new mounding activity is detected 2 or more days after strychnine/zinc phosphide baits or 7 to 10 days after anticoagulant baits. If hiring applicators, ensure that they are trained to distinguish active tunnels versus back-filled tunnels. Individuals who have been trained are twice as effective as those who haven't received training.

Here are some additional references and resources on gopher management:
http://vpcrac.org/files/3514/7612/1315/Pocket_gopher_chapter.pdf
http://ucanr.edu/sites/vpce/Pocket_Gophers/

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

SORTEX E BioVision™

Foreign material and shell removal with unmatched efficiency.

The revolutionary high definition BioVision™ combined with proprietary color optics, InGaAs and PROfile™ shape detection technologies, state-of-the-art broad spectrum lighting and high speed serviceable ejectors - offering nut processors state-of-the-art sorting performance.

Find out more.
T+ 1 209 983 8400 sortexsales@buhlergroup.com

Innovations for a **better world.**

BÜHLER

Photo Credit: Jim Markle

Spray Coverage is Key to Lowest Cost, Effective Pest Control

Franz Niederholzer
UCCE Farm Advisor, Colusa and Sutter/Yuba Counties

When prices tighten and costs rise, spending money is harder to do and pressure rises to trim a corner or two. This is especially true with spray application. However, a tough job, done right, gives you a better chance to not have to come back. [Bill Olson, retired UCCE Farm Advisor in Butte County used to say "The most expensive pesticide application is the one that doesn't work".] This column covers the three steps to achieving the best possible spray coverage in a particular orchard with a particular airblast sprayer. One size doesn't fit all. It will take a little work and it will pay off. If we continue to get a wet weather across the Central Valley into spring and summer, it could really pay off.

The first step in calibrating a sprayer for a particular block is setting appropriate ground speed. This sets the potential for spray coverage. Spray moves with air from the sprayer fan. More air is needed to move spray

through dense canopies compared to thin canopies. The easiest way to add more air is to reduce ground speed, giving the sprayer fan more time by each tree to push air into the canopy. Early in the season (dormant through petal fall) faster ground speed delivers the same air flow through the canopy compared to later in the season (leaf out through hull split) due to the limited leaf area.

The sprayer should travel just slow enough to deliver spray to and just above (3' or so) the center of the tree tops—the hardest place in the canopy to reach. To determine appropriate ground speed in a particular orchard at a particular time of the season, select tractor setting for your sprayer/tractor and fill the sprayer half-full of clean water. Tie a length of surveyor's tape (flagging) to the end of PVC pipe so there is 18-24" of free ribbon, and "thread" the pipe through the center of the canopy until about 3' of pipe sticks up above the tree top. Drive the sprayer down the row at regular operating speed, with the fan running. The nozzles can be on or off. If the flagging doesn't move as the sprayer drives by (no fan air reaches it), bring the sprayer around again and repeat the pass at lower speed(s) until the flagging just kicks out to around 45° off the vertical. That is a good tractor setting (gears, RPMs, etc.) to deliver adequate spray coverage potential throughout the tree. [If the flagging kicks up vertically (beyond 90° from a dead hang), speed up the sprayer.] To save time and money during early season, set ground speed at least twice a year-- once before leaf out and once after leaf out. If sprayer ground speed is set only once a year, do it just before hull split, because that is the toughest spray job of the year. Faster ground speeds deliver good coverage in the early season, but slow is the way to go once the canopy fills and the nuts pull down the branches.

Once spray coverage potential is set with ground speed, adjust spray flow to deliver good coverage with nozzle selection and placement. Just like more paint is needed for the exterior of a bigger house vs a smaller one,

Continued on Page 44

Photo Credit: Franz Niederholzer

A PVC pole in an almond tree with spray cards attached.

Continued from Page 43

more spray volume is needed through the nozzles targeting more leaf area. Since there are fewer leaves lower in mature nut trees and more leaves in the mid to upper canopy, most of the spray flow should come out of the upper nozzles on the sprayer—the ones that target the middle and upper canopy. The old rule is 2/3 of the spray volume out of the top half of the nozzles, but more recently I have seen recommendations of 2/3 of the spray volume out of the top 1/3 of the nozzles. Start with these general recommendations and adjust to your particular orchard. Park your sprayer in the orchard next to the tallest trees and note what nozzle bodies target what part of the tree. Turn off those sites that don't target foliage. Start with a target spray volume (gallons per acre) based on experience, the pesticide label, and discussions with your PCA. From the nozzle manufacturer's catalog, select nozzles (sizes and number) to target different parts of the tree. To help "load up" certain nozzle sites, nozzle "splitters" are commercially available to double or triple nozzle number from that spot on the spray manifold.

How much total volume should go out per acre? As for each nozzle, consider the target size, but this time for the whole tree. [Again, a bigger house needs more paint.] An acre of mature, healthy walnuts contains roughly 6 acres of leaf area (counting both sides of the leaf). Research from Dr. Joel Siegel, USDA Parlier, found better navel orangeworm control with more spray volume (150-200 gallons per acre) than with lower volumes (75-100 gallons/acre). A Chico area walnut grower significantly improved his mite control program by, among other things, upping his spray volume to 200 gallons per acre and slowing down to 2 MPH. If your mite or spring/summer disease programs are not performing as planned, more spray volume (in the right place) could be part of the answer. (Early in the season, less spray volume is needed compared to summer spray.)

Finally, check your coverage. Set up the sprayer with the ground speed and nozzle number/location previously worked out. Place water sensitive paper (yellow cards that turn blue when water hits them) throughout the canopy (using a pruning tower or ladder) and then spray the trees with just water and then check the cards. [See http://sprayers101.com/confirm-coverage-with-water-sensitive-paper/ for a great description of how to use water sensitive paper, although much more card coverage is needed for nut protection from worm damage than cited for "most foliar insecticides and fungicides".] Spraying Surround™ (white clay) is another way to check coverage. Placing one inch squares of blue painter's masking tape on leaves and nuts before spraying gives a great "before and after" contrast when the tape is pulled off after the spray has dried. Make sure you are getting the coverage you want without run off. All blue spray cards or white clay pools on the lower edge of leaves show you where chemicals are wasted. Adjust

Continued on Page 46

Photo Credit: Franz Niederholzer

A key step to directing spray is to just park the sprayer in the orchard and look at what nozzle sites are pointing at what part of the tree.

Continued from Page 44

nozzle number and/or location to give the coverage you want. Slight adjustments in ground speed and/or system pressure – up or down -- may help deliver the intended coverage.

Once ground speed and spray flow/coverage are dialed in, measure spray volume per acre to make sure the right amount of pesticide will be added to each tank to match the pesticide rec from your PCA. To do this, measure spray rate (sprayer output in gallons per minute; GPM) and land rate (area sprayed per minute; APM). Divide spray rate by land rate (GPM/APM) to give the actual gallons per acre (GPA) delivered.

To measure spray rate, fill the sprayer to overflowing with clean water and park it in a level space. Spray for a measured time (2-3 minutes) using the tractor/sprayer settings and nozzles determined in the orchard. Shut off the sprayer and refill the tank with clean water using a calibrated bucket or hose with a flow meter to measure gallons sprayed. Divide total gallons delivered by the sprayer run time to get spray rate (GPM).

To measure land rate, fill the sprayer half full and drive it in the orchard at the best coverage operating settings. Measure how many feet the sprayer travels in a minute, starting the timer only when the sprayer has reached steady speed. Multiply the feet/minute traveled by the row width (trunk to trunk across the tree row) to get the area sprayed in square feet per minute. Divide that number by 43,560 ft^2 per acre to calculate acre per minute (APM).

If you don't have time to do this, hire a consultant to dial-in your sprayer(s) for you. There is at least one company in California in that business (adaptiv.us) and their CEO, Matt Strmiska, spoke at the Almond Board conference last December.

See his slides from that talk –"Fine Tuning Spray Efficacy" – plus those from Brad Higbee, Wonderful Orchards, and Joel Siegel, USDA Parlier at www.almonds.com.

Taking the time to follow the steps outlined in this article will deliver the best possible outcome from a pesticide recommendation It could be the difference between needing only the minimum number of sprays dictated by pest pressure and playing an expensive game of catchup with disease, mites and/or insects.

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

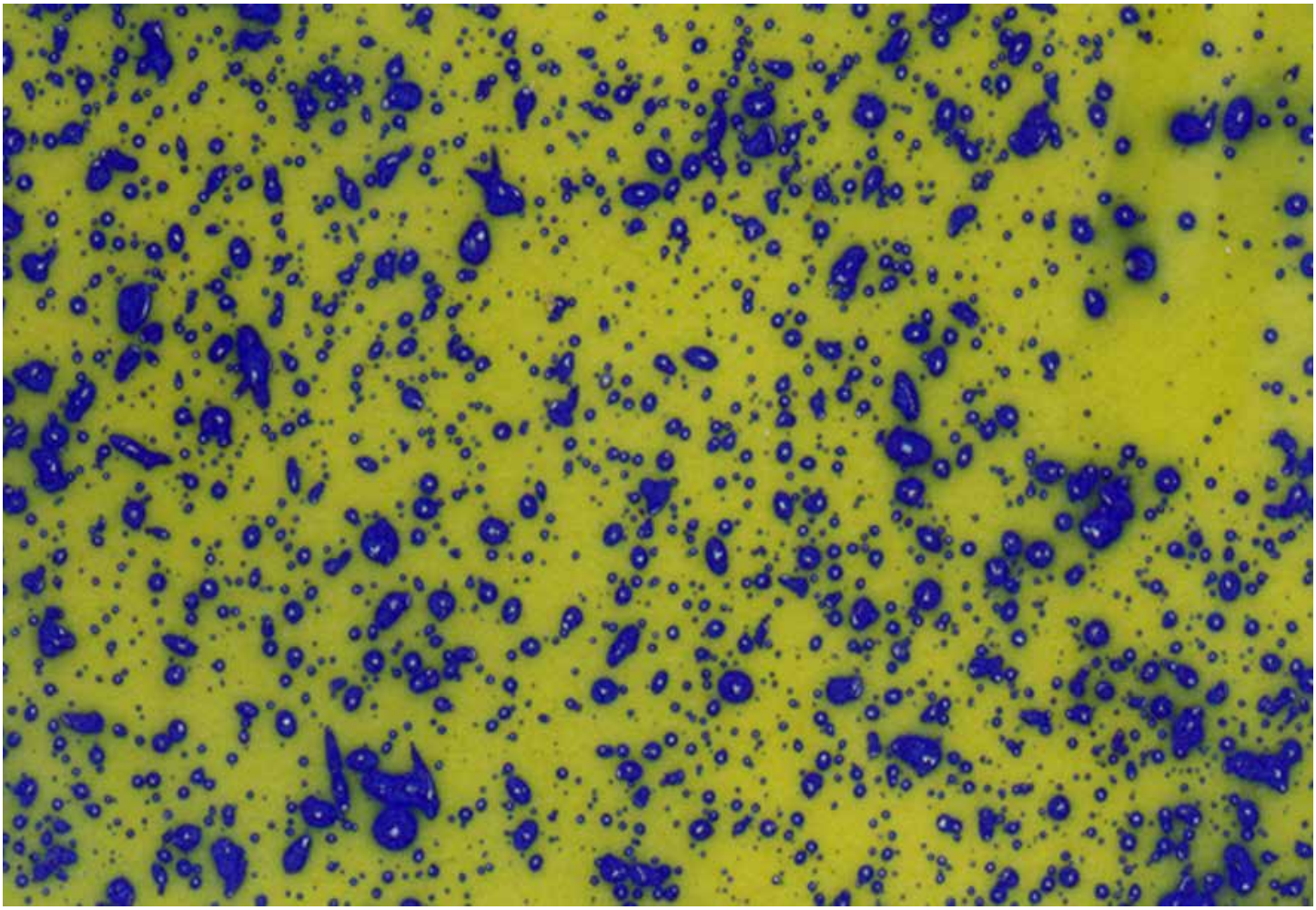


Photo Credit: Franz Niederholzer

Yellow water sensitive card. The blue spots are where spray drops have landed. These cards are great tools for assessing spray coverage.

CUTTING-EDGE PEST CONTROL IN TREE NUTS

Intrepid Edge® insecticide.

Two active ingredients and two modes of action combine to form one powerful insecticide. Intrepid Edge® offers fast-acting and long-lasting control of insects such as navel orangeworm, peach twig borer, codling moth and leafrollers. The two active ingredients impact all life stages of key pests. Intrepid Edge can be used as part of an IPM program that takes advantage of beneficial insect populations. Learn more at **IntrepidEdge.com**.

Intrepid Edge®
INSECTICIDE

DOW®

Dow AgroSciences

Solutions for the Growing World

Photo Credit: Len Wilcox

Phytogram sensor in a young pecan tree in a new orchard.

Electronic Dendrometrics Can Save Water and Money

Len Wilcox
Contributing Writer

This month's Ag Tech topic came about because a reader wrote us with a request for information. He wanted to know about the use of dendrometrics in water conservation. We're very glad he asked, as it sent us down a road that has been very interesting. What's more important is, we found a new water and nutrient monitoring method that could save growers money.

With recently developed electronic measuring techniques, a high-tech equivalent of the old-fashioned dendrometer is becoming an important tool for hi-tech tree and vine growers. It's helping them deliver water and nutrients only when

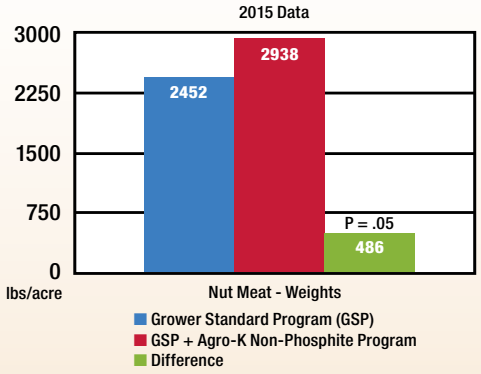
Continued on Page 50

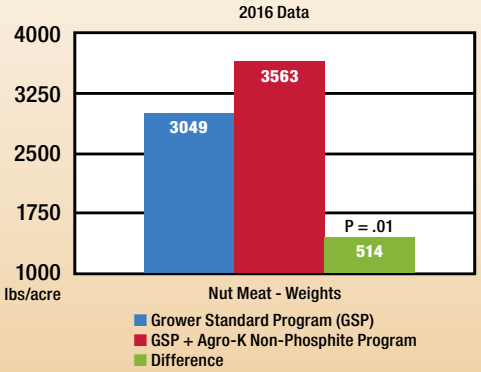
Two years of replicated data shows AGRO-K's science based nutrition program drives significant yield increases.

Right nutrients, Right form, Right time, Right mix.

Almond Trial
Var. Independence

Two Bees Ag Research – Escalon CA (Brooks Bauer)





Vigor SeaCal
Zinc Plus +4 DL
Vigor-Cal-Bor-Moly
AgroBest 9-24-3
BioMax Dual Action +

Maximizing profitability in your almond orchard starts with maximizing nut set every year. Achieving consistency in set and minimizing alternate bearing cycles is the key to consistent yields and higher profits. The secret is ensuring the tree has the right nutrients at the right time in the right forms and right mix. Agro-K's carbohydrate based foliar line including **Vigor-SeaCal, Vigor-Cal-Bor-Moly and Zinc Plus +4 DL**, are designed to help growers meet peak nutrient timings in the crop cycle.

Nut set can be influenced by boron which enhances pollination. Boron is synergistic with calcium and enhances its affect. Molybdenum plays a direct role in nut set and retention. Agro-K's **Vigor-Cal-Bor-Moly** is the perfect mix to apply from pink bud through bloom. Applying **Vigor-SeaCal** with **AgroBest 9-24-3** just prior to and during the bloom period provides rapid penetration, uptake and translocation of calcium and phosphate to help drive cell division setting the stage for large, dense nuts with maximum weight.

The energy requirements to maximize nut cell division leading to larger nut size is significant and requires large, healthy, and efficient functioning leaves. Zinc is essential for maximum leaf development, vascular function and root growth. Magnesium is critical for chlorophyll. Manganese is required for proper root development and nitrogen utilization. Agro-K's **Zinc +4 D.L.** provides these key nutrients helping maximize leaf surface area, ***chlorophyll*** and root growth.

Yield results of two consecutive years of replicated data, *on the same trees*, are shown in the charts. **The increases on the treated plots equaled 486 and 514 lbs./ac in 2015 and 2016 respectively. These nut meat yields were statistically different from the grower standard practice at the 5% level (P=.05) and 1% level (P=.01) respectively.**

The trial was replicated six times on 4th and 5th leaf *Independence* variety almonds using the same replicate plots in both years to demonstrate not only efficacy of a complete foliar and soil nutrient program but also the cumulative benefits of the Agro-K program built on sound agronomic principals and designed to maximize yield and minimize alternate bearing.

Almonds naturally tend towards alternate bearing. Meeting peak nutrient demand at all stages of crop growth and tree development is critical to maximizing tree growth and health in the current year and to set the stage for next year's production. Achieving consistent above average yields year over year requires a thorough understanding of plant physiology and nutrient demands, the right tools to address the nutrient requirements on a timely basis, and the commitment to stick to a long-term science driven approach to nutrient management. If you are interested in increasing yields on a consistent basis, talk to your PCA today about Agro-K!

AGRO-K®

Science-Driven Nutrition™

AGRO-K CORPORATION
8030 Main Street, NE • Minneapolis, MN 55432 • 800-328-2418 • www.agro-k.com

Dendrometer band on tulip popular tree, photo courtesy Smithsonian Environmental Research Center's Global Tree Growth Project.

Continued from Page 48

the plant needs them. This can provide a potential savings in water and fertilizers. It is a demand-based water and nutrient management system based upon careful measuring of plant fluids.

Dendrometers have been used to evaluate the health of orchards and forests for years. They are metal bands that encircle the tree's trunk and measure changes in the circumference. These changes happen not only when the tree grows; water flowing from the roots to the branches will also cause the trunk to swell. This measurement can help an astute grower determine peak water demand. It will tell him whether that demand is being met, before the tree suffers from dehydration.

An electronic version of a dendrometer can be inserted into the sapwood of the tree to measure the flow of water. These sensors can also determine what nutrients are being carried with the water. Developing this precision electronic sensing and measuring system has been the lifelong work of William Gensler of Tucson, Arizona. Gensler is a professor emeritus at Arizona State University and the president of Agriculture Electronics Corporation. That's the company he founded to market his Phytogram system as well as the manual and automatic dendrometers that his company manufactures. His Phytogram system is the result of 25 years of research and development.

"The whole idea is, give the plants water only when the plants want water, and give the plants nutrients only when the plants want nutrients," Gensler said. Such precise management is now possible with the real-time monitoring provided by electronic sensors. "The phytogram monitors the water flow in real time, as well as the nutrients, and nitrate levels. The grower knows instantly what is happening inside his trees."

His Phytogram is a comprehensive unit of 15 sensors, hard-wired to a central unit, which transmits the data by cellular or wired connection to the internet. In a typical installation, sensors are needle-like metal rods that are inserted into the sapwood of the main trunk. Usually one sensor is used per tree. However, some growers place a second sensor in a petiole to gain early warning of dry conditions. With either sensor, the grower is able get the readings instantly. They are transmitted from inside the plant to the central

pod then transmitted to the grower's internet connection, on a continuous basis.

Gensler pointed out that the Phytogram works without any labor output. No one has to go read the Pods or a dendrometer. The data is obtained via telemetry and travels straight from the tree to the grower's computer. The fluid flow and nutrient data is instantaneous and continuously updated, so it is very timely as well.

He further explained that the system is able to identify nitrates in the fluid, as well as potassium. This is possible because the nutrients inside the plant are ions. "By counting the ions in the extracellular fluid and identifying the type of ions," Gensler said, "we determine the timing and magnitude of ions present in the vicinity of the surface."

This allows two methods of identification.

"The first method uses the speed of movement of the ion as an identifying characteristic. Nitrate ions move faster than potassium ions under the same electric force field," he said. "By measuring the speed of the movement of the ion from the surface to the bulk and in the opposite direction one can identify the ion."

The second method of identification is more technical, and calls upon sophisticated electric engineering, according to Gensler. "An electrical potential is applied which differs from the measured quiescent potential of the surface for a brief period of time. This causes a reconfiguration of the ions adsorbed on the surface such that cations move from the surface to the bulk and anions move from the bulk to the surface. The relative speed of the movement of the anions and cations is different," he explains, and this allows the type of nutrient present to be identified.

The Bottom Line:

Measuring liquid and nutrient flow inside the tree in real time could allow a grower to save money by changing how much they irrigate and fertilize. Here is how: at present, growers supply water and nutrients at set intervals. Their goal is to provide what they expect the trees will need. This is something of a guessing game, and growers tend to provide more than is needed to insure they meet the tree's needs. If a grower is monitoring the water and nutrient levels inside the tree, he knows how much the tree will use - it's no longer a guessing game, he has hard facts to work with. He need only supply the amounts that the tree will take up and put to good use. When the tree has all it can handle, the application can be stopped. This is a demand-oriented system that should reduce irrigation and fertilization costs.

For more information about the Phytogram system, contact William Gensler at 520-624-7656 or visit his website at www.phytogram.com.

We are always pleased to hear from our readers with requests for information or review of high-technology farming equipment and apps. We'd like to know more about your needs and interests in this field. Let us hear from you. Feel free to send us an email at article@jcsmarketinginc.com with suggestions of Ag Apps or Ag technology to review.

Photo Credit: Almond Board of California

Nitrogen from irrigation water and other sources is taken into account when using the Almond Board's online Nitrogen Calculator.

Nitrogen Calculator Optimizes N Use, Simplifies Reporting Requirements

Almond Board of California
Contributing Writer

Under the Irrigation Lands Regulatory Program (ILRP), Central Valley Water Quality Coalitions' reporting requirements include farm evaluations, nitrogen summary reports, and a sediment and erosion plan. In high-vulnerability groundwater areas, growers are required to submit certified summary reports annually; in low-vulnerability areas, the report must be kept on-site and certification is not required.

It is important to comply with these requirements, as the Central Valley Regional Water Board is actively enforcing the program with heavy fines for growers who either have not signed up for a coalition or who have not submitted a Nitrogen Management Plan.

N Calculator

Almond Board of California (ABC) has created a tool, the Almond Nitrogen Calculator, that not only helps almond growers to manage nitrogen applications for efficient fertilizer use, but also generates a Nitrogen Management Plan as required by ILRP. The N Calculator:

- Calculates fertilization rates based on newest UC nitrogen management research
- Employs the Four R's of nutrient management (right source, right rate, right timing and right location)
- Is based on almond crop demand and accounts for vegetative growth, as well
- Enables efficient fertilizer use
- Has a library of fertilizers in pull-down menus for easy rate calculations, based on data you put into the system
- Calculates nitrogen contributions from non-fertilizer sources, such as groundwater, compost and legume cover crops
- Recalculates fertilizer rates as April leaf sample data and/or better yield estimates become available during the season
- Can clone the N budget from one orchard to another within and between years if orchards are similar

This tool uses models developed by UC Davis plant scientist Dr. Patrick Brown and colleagues to predict how much nitrogen to apply and when to apply it to meet yield-based demand. To use this tool, growers enter their yield

estimates pre- and post bloom, and then add early-season tissue-sampling results. "The Nitrogen Calculator is not only a powerful tool that calculates N requirements, but is also tied to regulatory compliance with, the ability to create the required Nitrogen Management Plan Worksheet under the ILRP," said Franklin Dlott, product manager for SureHarvest, which developed and manages the calculator for Almond Board of California.

Responsive Model

"The model for the Almond Nitrogen Calculator is responsive, and you can revise your yield estimate as many times as you see fit between post bloom and final harvest," Dlott continued. "The model that Patrick Brown came up with includes all of the elements that are required for reporting under the ILRP. It has estimated yield, fertilizer plan, actual yield, and accounts for nitrogen credits from irrigation water and other sources, so by hitting one button, growers can produce the Nitrogen Management Plan Worksheet required by coalitions." SureHarvest works closely with the coalitions to be sure each coalition's reporting requirements are met, added Dlott.

Mobile Friendly

A presentation on the Almond Nitrogen Calculator was given at The Almond Conference last December, according to Dlott. At this presentation, new features of the N Calculator were introduced. These include:

- A mobile-friendly update that allows access with smartphones and tablets for on-the-go data entry, calculations and report generation
- On-screen guides and a "take a tour" guide for first-time users, as well as pop-up guides for specific steps within the calculator

Although already a popular tool among almond growers, "There has been an uptick in new users since The Almond Conference," Dlott noted.

Robert Arnold, with Farmland Management Services, Shafter, has made good use of the N Calculator. In 2016, Arnold began using it for all properties he manages, which are in Tulare and Kern Counties, plus additional properties in Northern California.

"I played around with the calculator for a while until I could figure out how to make it work, and then I used it on all our almond properties, generating multiple Nitrogen Management Plans," he said. The most important feature of the N Calculator, Arnold asserted, is that it generates nitrogen requirements so you don't exceed them when making applications.

Saving, Cloning Data

Another benefit he found is that the Nitrogen Calculator saves information from year, to year and only revised information has to be input. Arnold also utilized the cloning feature, using data from one field for a similar field, making modifications as necessary. "Often, the soil is way different, and almost every time the water is different," he cautioned. "You don't want to assume too much — water coming from different wells may have different N content."

SureHarvest maintains SustainableAlmondGrowing.org, where the Almond Board's Nitrogen Calculator, Irrigation Calculator and Mapping Tool can be accessed. This is also where you will find modules to fill out under Almond Board of California's California Almond Sustainability Program (CASP). CASP uses grower-submitted production information to demonstrate the sustainability[1] of the California Almond industry to stakeholders — buyers, regulators and consumers — and helps growers find ways to improve efficiencies. For more on CASP, go to Almonds.com/Growers/Sustainability.

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

1. Sustainable almond farming utilizes production practices that are economically viable and are based upon scientific research, common sense and a respect for the environment, neighbors and employees. The result is a plentiful, nutritious, safe food product.

Pecan orchard at harvest.

Photo Credit: Kathy Coatney

Pecans Have a Bright Future in California

Kathy Coatney
Editor

Pecans are considered a minor crop in California. There are no firm estimates on total acreage, but according to Mark Hendrixson, president of California Pecan Growers, in Orange Cove, California, there isn't a good count on statewide acreage at this point.

"We might be getting close to 5,000 acres," Hendrixson said, but he doesn't know that for sure.

Garry Vance, a pecan grower/huller and owner of Northern California Pecan in Corning, California, said, there are about 1,500 acres of pecans in the northstate. There are also some new plantings in Colusa County and that acreage isn't included in the 1,500 acres, he added.

2016 Crop

The spring bloom was positive for northstate growers, Vance said.

"There was some drop in some Pawnee orchards, but we haven't determined what exactly has caused that yet," Vance said.

The crop was up for the north state at about 1.6 million pounds for 2016,

Continued on Page 56

40 Years of Farming Experience

WRT
RESTORING LIFE

The Foundation of your Fertilizer Program

High Phos™ is a unique source of phosphorus with potassium and chelated iron designed for use in the soil.

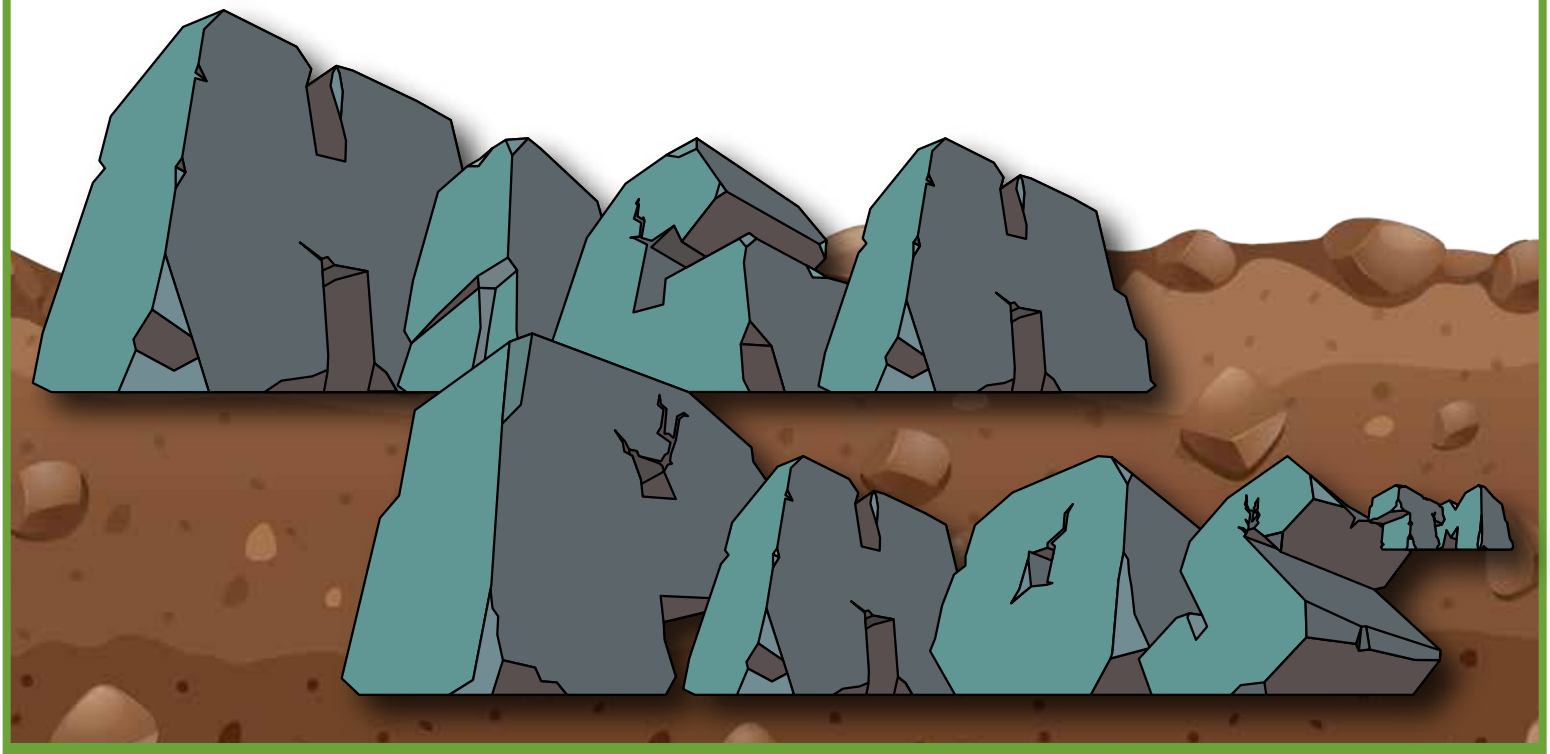
Phosphorus is required in high levels to supply the many energy requiring reactions in the metabolism of the plant. The polyphosphate is readily converted into usable forms and is soluble in the soil solution for uptake into the plant.

The balanced formulation of essential nutrients contains organic and amino acids to stabilize the nutrients and facilitate their chelation, uptake, translocation and use.

- *#1 choice for supplemental phosphorus*
- *Enhance the phosphorous levels in your soil*
- *Greater root growth and increased uptake of phosphorous*
- *Growers use less and save valuable time and money due to the effectiveness of High Phos™*

BAICOR, L.C.

WRT Inc is a licenced distributor of **Bio Si** and **Baicor** products.



Contact Joseph Witzke: 209.720.8040 or Visit us online at www.wrtag.com

Photo Credit: Elizabeth Fichtner

Aphid damage to pecan tree.

Continued from Page 54

Vance said.

"I think the average price is going to be somewhere around $2.50-$2.75 a pound to the grower," Vance said, adding the price is up a little from last year.

Keith Larrabee, a pecan grower and owner of Larrabee Farms in Chico, California, said, his crop was good and so was the quality and pricing.

"Overall I think California continues to improve it's production on pecans," Larrabee said.

Weather wasn't an issue at harvest in 2016, Larrabee said. "It can be, but typically we go through and shake them and harvest them twice."

"Our first pass through is around the middle of October, which is typical of the Chandler (walnut) harvest as well," Larrabee said.

"We typically get 70-90 percent of the nuts on that shake, and then we turn around and wait into the first part of November, and do a second shake, and we typically get the balance," Larrabee said, adding that's usually the challenging time period for harvest is

the second shake.

The weather generally causes issues with getting equipment in, not problems with the nuts, Larrabee said.

"That's the difference between pecans and walnuts is pecans have a very tight shell, so typically we don't see issues like mold," Larrabee said, whereas with walnuts there will be issues with mold if they're laying on the ground and it's wet.

Hendrixson said 2016 was a better crop than last year for the central part of the state.

"Now, that's not saying a whole lot, but it was a better crop. The quality wasn't quite what everybody hoped for. It was off a little bit, but still it was a good crop," Hendrixson said.

"What I'm seeing, not just in pecans, but other stuff is we're kind of coming out of the stress from the drought and that takes a little time to work through," Hendrixson said.

Some growers are still harvesting in the central part of the state, so total crop size for 2016 isn't available, yet, Hendrixson said.

Ben King, a pecan grower and owner of Pacific Gold Agriculture, is the largest grower/processor in the state, with offices in Visalia and Colusa.

King is just finishing up harvest in McFarland, and he estimates the crop will be about 2,500 pounds to the acre for 2016. That's coming off of two years of about 3,000 pounds to the acre, he said.

King said, they hedged a little heavier in 2016 which reduced the crop a little.

Aphids

Aphids are the main pest for California pecan growers and pressure was normal this year, Vance said.

Vance has had chemical resistance problems because of the limited number of chemistries available to treat the aphids.

"We're spraying a lot more than we used to," Vance said.

"There's been talk about a new chemistry for pecans called Sequoia that we've been working at trying to get registered," Vance said.

Continued on Page 58

Photo Credit: Elizabeth Fichtner

Aphid damage to pecan tree.

Continued from Page 57

"I'm not sure where they're at on that. They were talking maybe a Section 18, but I haven't seen anything on it for awhile," Vance said.

"Aphids are our issue," Larrabee agreed.

"That is one concern about being a minor crop in California is the availability of materials to be able to control them. The materials that are out there seem to be less effective all the time," Larrabee said.

"This year the aphid pressure was very high in the Central Valley," Hendrixson said.

"They're talking about eliminating Lorsban," Hendrixson continued, "and that's our biggest hammer for aphids."

"That's kind of the tool of last resort, and that's going to complicate the resistance problem," Hendrixson said, adding, "I think it's still a couple of years away before Lorsban is gone."

Growing Interest in Pecans

Karlene Hanf is an orchard specialist with Linwood Nursery in La Grange, California. Hanf said, "there is definitely more interest in pecans."

"In California, many growers are looking at pecans to diversify with," Hanf said.

"Production wise a lot of growers like to go with the Wichita combination because Wichita is an excellent hedging tree and production is the highest in the state," Hanf said.

"For growers that want a later harvesting nut, the Pawnee is a good choice, but it can harvest into February," Hanf said.

"There are some new varieties coming from Georgia," Hanf said. "They're big nuts, they fill really well."

"The fact that it's a Pawnee/Wichita cross is kind of an exciting cross because it pulls the good attributes of both of them," Hanf said, "and they have an earlier harvest."

"With pecans you've got to be careful because they're going to be there for the long haul. A pecan tree can last 100 plus years, and you don't want to plant the wrong thing, so you have to be careful with what you do," Hanf said, adding growers are going to want to plant new varieties with caution.

Federal Marketing Order

The federal marketing order was an involved process that included many different states across the country, and there were the pecan processors, too, so there were a lot of different interests, King said.

"I think it's definitely a positive step for the industry, and we're in the process now of actually collecting assessments for the first time," King said.

There are two key points to the marketing order, King said.

- It allows for collective action for an industry
- It provides funds for marketing and research, allowing pecans to take their place with other major tree nuts

Larrabee said without a doubt the federal marketing order will be a good thing for the industry.

"Just knowing and being involved in other marketing orders, and other crops, I know that it's going to be a huge benefit to the pecan industry once it gets up, and running, and gets programs going," Larrabee said.

Hendrixson said the federal marketing order will absolutely be a good thing for the industry.

"The pecan industry has not had a unified voice in the market place to spread the benefits of pecans," Hendrixson said, "not just the flavor, but also the health benefits."

The Future of California Pecans

King's goal is to expand the pecan industry in both parts of the state, but more likely in the Sacramento Valley mostly due to water availability there, he said.

"I think the highest and best use for a lot of that land up there, that hasn't been planted in almonds and walnuts, is pecans," King said.

"I really believe we can have 50,000 acres of pecans, mostly in the Sacramento Valley, in 20 years," King said. "That's what I'm going to try to do."

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

NON-GMO

BIOSTIMULANT FERTILIZERS, PEST CONTROL & BIO FUNGICIDE

INCREASE FLOWERING AND FRUIT PRODUCTION WHEN USING PURE PROTEIN DRY

99% OF NITROGEN DERIVED FROM FISH PROTEIN HYDROLYSATE, INCREASES WEIGHT OF FRUITS & VEGETABLES

PURE PROTEIN DRY

15-1-1 • 11-13-8

5-12-14 • 7.5-1-25

PRIMO AMINOS

18 TYPES OF AMINO ACIDS
80%+ AMINO ACIDS
100% WATER SOLUBLE

CONTAINS IRON & ZINC
PLUS BENEFICIAL MICRO ORGANISMS

BACILLUS SUBTILIS
FIGHTS POWDERY MILDEW
BACILLUS THURINGIENSIS
HELPS TO CONTROL BORER LARVAE





Weed-a-Way

CONTACT
OR
PRE EMERGENT
HERBICIDE

EX-ICUTE™ & RID-BUGS

25(b) OILS MINIMUM RISK ORGANIC INSECTICIDE:

AND BIO FUNGICIDE CONTROLS:

REGISTERED MATERIAL For Use in Organic Agriculture Washington State Dept. of Agriculture
WSDA LISTED

cdfa

OMRI LISTED® For Organic Use

Organic AG Products

www.OrganicAGProducts.com

Guaranteed by AZ ENTERPRISES INC DBA ORGANIC AG PRODUCTS
2367 Brant St., • Arroyo Grande CA. 93420

SALES CONTACT INFO:

JOE HASLETT
(805) 748-4033
joehaslett.oap@gmail.com

ED ZYBURA
(805) 550-7776
edzybura@charter.net

Avoid Stale Soil–Activate™ It!

Why Activate™?

- Highly concentrated, guaranteed species analysis
- Naturally occuring root colonizing organisms, not genetically modified
- Stimulates root and plant growth
- Enhances nutrient cycling and a reduction in nitrogen needs
- Reduces leaching of nutrients

Nature At Work

Soil and Crop

34284-B Road 196
Woodlake, CA 93286 | Tel: 559.564.1236
Fax: 559.564.1238 | info@callnrg.com
www.callnrg.com

Product Manufactured by Natural Resources Group

NRG NATURAL RESOURCES GROUP