Field Notes
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Nitrogen Fertilization is Important on First-year, Second Generation Almond Trees Following Whole Orchard Recycling

Whole-orchard recycling (WOR) involves grinding whole trees into wood chips, spreading the wood chips evenly on the soil surface, and incorporating them into the soil before replanting. A recycled orchard returns approximately 30-60 tons of wood chips per acre depending on the previous orchard tree size, spacing, and variety. The large quantity of woody debris contains an estimated 30,000 to 60,000 lbs of organic carbon (C). There are benefits and tradeoffs associated with returning this large volume of C into the soil prior to replanting. Organic C, which is the C stored in organic matter, promotes the physical and microbiological properties that influence water infiltration, retention, and aeration. The enhanced soil structure promotes tree root growth and may reduce the incidence of replant disease. However, the higher carbon to nitrogen (C:N) ratios of organic amendments, like wood chips, can decrease the availability of applied N fertilizers. Consequently, growers may need to apply fertilizer N at rates greater than what is normally recommended for trees in their first leaf. Another concern is that the woody debris may be so large that it interferes with normal soil preparation and orchard management practices. If WOR can be managed so that it does not reduce the availability of nutrients for new trees, worsen replant disease, or interfere with harvest, and yet enhances long term soil health and nutrition, then growers will be more likely to adopt grinding and incorporating as an alternative to burning the woody debris from their orchards.

In our initial orchard grinding trial established in 2008 at the Kearney Research and Extension Center, stone fruit trees were recycled at 30 tons per acre using the Iron Wolf (a 50-ton rock crusher), and compared to field burning and incorporating the ash. The second orchard was replanted to almond, and ultimately, greater yields, significantly more soil nutrients, organic matter, and total carbon were observed in the grind treatment compared to the burn treatment. Leaf petiole analysis also revealed higher nutrient levels in trees growing in the grind treatment, thus indicating that in the long term, the high levels of organic matter from the recycled orchard did not stunt replanted trees. Later studies at Kearney found that WOR increased the soil water infiltration rate and soil moisture retention, while decreasing soil compaction and bulk density. Significantly higher microbial biomass C was observed in the WOR treatment while microbial biomass N was decreased. A deficit irrigation trial established at Kearney provided evidence that trees growing where the previous orchard was recycled showed less water stress. Based on the positive results from this trial, and the closure of co-generation plants, we estimate almond growers have chipped and incorporated more than 20,000 acres since 2015.

With the adoption of WOR, eight additional research trials were established throughout California to further evaluate the impacts of WOR on tree health and soil quality. Initial observations in the new trials revealed that our N recommendations for first-year almond trees after WOR needed revision because reduced shoot growth in second-generation orchards was often observed in early spring after replanting. As a consequence, N applications were increased to address the likely imbalanced C:N in the soil.

In a previous study conducted by David Doll, UC Farm Advisor in Merced County, he determined that first-year almond trees grew best when given between 3-4 ounces of actual N (25-35 lbs N/acre) in their first growing season. The applications are typically spread out so that no more than one ounce of actual N is applied per tree per application. This recommendation may not be enough following WOR, especially if 40-60 tons of wood chips are incorporated back into the soil. In 2017, working in Louie Tallerico's recycled orchard in Manteca, we tripled David's recommendation after we noticed reduced shoot growth, and we applied 11 ounces of N per tree (approximately 100 pounds N per acre). Trees that had initially showed reduced shoot growth responded nicely to the additional N. Another factor that needs studying is the reduced efficiency of applying N through a double-line drip system, where only an estimated 20% of the emitters reach the tree roots early in the first year. As the trees mature, the double-line drip system will obviously become more efficient, delivering N to trees with larger root systems.

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

Our first N application in March seemed to have an almost immediate impact. Considerable precipitation in March effectively dissolved the granular N, and differences in shoot growth were detected among treatments soon after. Leaf analysis showed that N treatments early in the season seemed to have a greater impact on N tissue levels than applications later in the season (Figure 1). Trunk diameter data showed that we did not receive any additional benefit for applying more than 4.0 ounces of actual N per season (0.8 ounces of N per tree rate) in addition to what the grower applied (Figure 2).

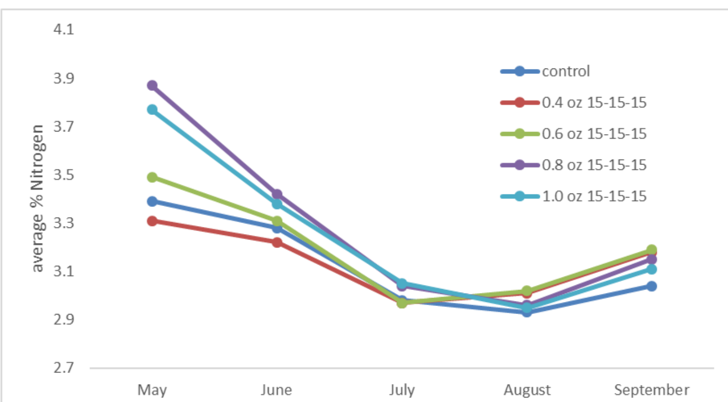

Figure 1. Percent N in leaf tissue from May-September.

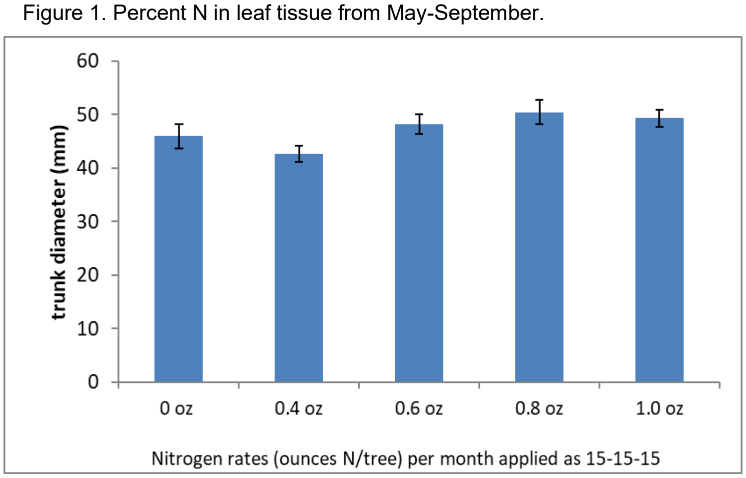

Figure 2. Trunk diameter of first-year almond trees given monthly applications of nitrogen in addition to the grower-applied N.

Timing of N may be more critical early in the growing season after WOR. In Dr. Greg Browne's studies, where he applied N with WOR and anaerobic soil disinfestation, he too observed an increase in shoot growth early in the spring with early N applications. It may be that we can use N more efficiently if we apply it earlier in the growing season or at planting time. We will attempt to study N use efficiency in more detail in future trials, but at this point in our research, we would recommend that growers apply at least 6-8 ounces of actual N per tree (50-70 lbs N/acre) in the first year of tree growth following WOR, and that early applications appear to be more important than applications later in the season. Remember that N applications should be spread out so that no more than one ounce of actual N is applied per tree per application in the first year of tree growth.

In our WOR trials, we did not have to apply additional N in the second year of our studies to achieve the tree growth we expected. We hypothesize that in the first season after WOR, the microorganisms decomposing the wood chips compete for the N applied to first-year trees. The wood chips and soil microorganisms may also bind and immobilize excess N that may otherwise leach through the soil profile in the spaces between trees where young tree roots have not yet grown. As the wood chips decompose, N should be released slowly and become available for uptake by the trees. Increased N use efficiency may be observed as the wood chips decompose and release bound N. Samples of the wood chips were analyzed for their nutrient content, which averaged 0.31% N, 0.20% potassium (K), 0.60% calcium (Ca), and 50% C. Returning 64 tons of wood chips to the soil per acre provided 396 pounds of N, 768 pounds of Ca, 256 pounds of K, and 64,000 pounds of C per acre. These nutrients will not be immediately available to the next-generation orchard, but as the woody material decomposes and soil organic matter increases, the stored nutrients will be released.

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

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

Brent Holtz, Farm Advisor and County Director

Landscape Trees: To Fertilize or Not to Fertilize

One of the most interesting talks at the [Landscape Below Ground Conference](https://thelandscapebelowground.com) (https://thelandscapebelowground.com) in Chicago in October 2018 was given by Daniel Herms of Davey Tree Company. His lab looked at the effects of fertilizers, growth regulators, and high and low nitrogen mulches (compost vs. chipped pallet wood) on growth, drought-tolerance, and pest and disease resistance in landscape trees.

A general trend emerges from each experiment when trees are given more nitrogen than is found in the native soil, extra top growth results. The question is this: **is this a good thing?** You may have a larger canopy, but at what price? In fact, it turns out this is **not** a good thing.

Effects on Stability and Drought-Tolerance

When top growth is produced out of proportion to root growth, you end up with a tree that is unstable in the landscape. When trees are allowed to grow at their natural pace, they will adjust and balance their canopy growth and root growth through a series of feedback mechanisms between roots and shoots. When you "juice" the canopy growth with readily available nitrogen, you get a top-heavy tree prone to toppling in wet-soil/high-wind situations. And, of course, if you have more leaves than roots, you become less tolerant of drought conditions as well, since your leaves will demand more water than your root system can provide.

Effects on Pest Tolerance

Another by-product of fertilization is an abundance of lush, tender foliage that is attractive and susceptible to insect pests. In normal conditions, many plants will produce compounds that give them a degree of resistance to pest attacks, whether insects or diseases. But under the luxurious conditions produced by fertilizer applications, the plants will sacrifice producing these compounds in favor of more lush leaves. It's sort of like over-feeding them and making them fat, lazy, and prone to invaders. The result is that, at least in the species examined, trees were more prone to both insects and disease when fertilized - just the opposite of what many people believe!

Mulch Material

It is still confirmed over and over by research that organic mulch in the root zone of trees produces more fine roots, less compaction, and higher levels of beneficial microbial activity that contributes to the availability of necessary nutrients for tree growth. One aspect of any organic mulch is the carbon-to-nitrogen ratio, sometimes written as C:N. Typical chipped wood has a high C:N ratio - there is much more carbon than nitrogen - whereas something like composted steer manure has a low C:N ratio, with high levels of nitrogen. In fact, most any fully composted green-waste is going to have a much lower C:N level (more N) than a simple chipped wood material, because microbes have already digested a good portion of the carbon and converted some of the nitrogen to a form readily available to plants. Adding this type of material directly to the surface as a mulch application has much the same effect as adding a nitrogen fertilizer rapid top growth to the detriment of overall tree health and landscape stability.

The bottom line is this: if you are doing pre-plant soil preparation, adding compost and tilling it in to improve soil structure and organic matter content is a great practice that gets trees off to a good start and sets them up for longevity. After you plant, an **uncomposted, chipped wood** product, renewed every few years, is best for a mulch top-dressing (Figure 1). This product will break down slowly contributing additional organic matter at a rate that does not compromise soil microbe activity and doesn't add too much nitrogen to the tree's growing environment.

Figure 1. Mature oak with mulch.

This is good news! You don't really need to spend any of your budget on fertilizers for your landscape trees (and I should add that the same goes for woody shrubs), and the best mulch is the relatively inexpensive and readily available chipped wood available from any tree-trimming operation! Not only are you doing your landscape a load of good, you are also keeping organic waste out of the landfill.

Karrie Reid, Environmental Horticulture Advisor

Mineral Status of Cattle in California

As a result of a Russell L. Rustici Rangeland and Cattle Research Grant, my colleagues and I sampled breeding cattle in the state to determine mineral levels. We found cattle are sufficient for some minerals, but there are deficiencies needing to be addressed. Minerals play a vital role in the health and well-being of cattle, and some play an important role in reproduction. Knowing what your levels are will help you determine if your mineral program is working, or if you need to start a mineral program. Statewide, cattle are receiving adequate levels of minerals in their diets overall. We did find regional differences for some minerals, and cattle in our

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region have below critical levels of selenium compared to the rest of the state. In our region, 28% of cattle are below critical levels, compared to 3, 4, and 2% of cattle in the Intermountain, Northern foothill, and Southern parts of the state, respectively. Selenium deficiency is also known as white muscle disease and affects calves, with up to 40% death rate. Symptoms vary but can range from a weak calf not able to stand, to one standing and walking stiffly, to muscles swollen and firm to the touch. With over a quarter of the cattle in our area deficient in selenium, it is important to check your mineral program to be sure you are providing adequate levels.

Other minerals that are of concern in our area include copper (31% of cattle are deficient), zinc (23% are deficient), iron (62% are deficient) and manganese (92% are deficient). Statewide, 92% of cattle are deficient in manganese, a mineral that plays a role in reproduction, but until now we had no record of the levels in breeding cattle. Manganese deficiency can reduce the cow's ability to breed through reduced conception rates, abortions, silent heats and cystic ovaries. In addition, low levels passed to the calf cause skeletal deformities with enlarged joints, limb deformities, or small and weak calves. With such a high proportion of cattle below critical levels of manganese, without a corresponding increase in symptoms of deficiencies, we wonder if the critical level is actually higher than what has been previously reported.

Cattle in the Central region are typically above critical levels for magnesium, calcium, phosphorus, potassium, and sodium. Take a look at your mineral program and your breeding records. If you see any issues with your records in regard to calving rates, calving interval, or weak or deformed calves, you may want to look at your mineral program and see how you can improve some important minerals for your ranch.

Theresa Becchetti,
Livestock and Natural Resources Advisor
Stanislaus and San Joaquin Counties

Evaluation of Grafting for Processing Tomatoes, north Delta, CA, 2018

This past season I continued working on evaluations of grafted tomato in close collaboration with Gene Miyao (UCCE Yolo, Solano and Sacramento counties) and Zheng Wang (UCCE Stanislaus, Merced and San Joaquin counties). We have funding from USDA to continue this work into 2019 and 2020.

In 2018, a trial was conducted in a commercial processing tomato field located in the north Delta, Sacramento County. Soil type was a Gazwell mucky clay. Field trial design was a randomized complete block with four replications. Each plot was a single bed by 65 feet. Bed configuration was a single plant line on 60-inch centered beds with a roughly 14-inch spacing within the row, for a target plant population of 7,500 plugs per acre. At five days post-transplanting, any missing or dying plants were replaced by hand transplanting. The field was sprinkler-irrigated a single time five days after transplanting, and then was irrigated by a subsurface drip system for the remainder of the season. Aside from the one hand replanting effort, the trial was managed by the grower similarly to the rest of the field. The trial was mechanically transplanted with commercial planters on May 30th and mechanically harvested on October 19th (delayed harvest). Fruit yield was measured using a portable cart with weigh sensors to collect fruit off the mechanical harvester. Prior to the sorters, a five-gallon subsample of fruit was taken from the harvester and hand sorted to measure culls and fruit maturity by weight. Small, bagged samples of good red fruit from each plot were delivered to the Processing Tomato Advisory Board (PTAB) inspection station in Escalon to determine fruit color, soluble solids and pH.

We evaluated three tomato rootstocks. Two are commercial rootstock cultivars developed by De Ruiters and sold by Seminis Vegetable Seeds: Maxifort and Multifort. The third rootstock is a pre-commercial cultivar which the company did not disclose to us. We grafted three different scion cultivars (N 6428, DR 0319 and HM 3887) onto each rootstock; for a total of nine different scion x rootstock combinations. These grafted plants were compared to a non-grafted control for each scion (transplanting normal transplants for each cultivar). Grafted plants were produced by California Masterplant, Tracy, CA.

Results. Table 1 (page 5) shows results for fruit yield and cull rates. We also measured plant vigor, fruit cover at harvest, NDVI ("greenness") and harvest date (data not presented). The two De Ruiters rootstocks resulted in higher vigor, better fruit cover at harvest time, and increased yield by an average of 39 percent. The range of yield increases on these two rootstocks was 14 to 55 percent, depending on the rootstock-scion combination. On the downside, the optimum harvest date was delayed by about five days by grafting onto vigorous rootstocks, and fruit from some Maxifort-grafted vines had slightly poorer color. The pre-commercial rootstock did not significantly affect yield or other vine or fruit attributes. The 39 percent yield increase we observed with the two rootstocks is about twice what we have seen in three previous trials over three years, where yield increases ranged from 8 to 19 percent. It may be that with our late season planting and delayed harvest (142 days from transplanting to harvest), the later setting fruit had the opportunity to reach maturity. Or perhaps grafting was more advantageous at this site because of some location-specific (soil or microclimatic) effects.

We acknowledge funding for this project from USDA (grant # 2016-51181-25404) and we greatly appreciate the generous cooperation of our industry collaborators: Andrew Petrini, Fonseca & Fonseca, TS&L Seeds, and California Masterplant.

Brenna Aegerter, Vegetable Crops Advisor

Table 1. Yield, fruit quality and maturity, and culls from grafted and non-grafted plants of three cultivars. North Delta, 2018.

Scion	Rootstock	Yield (tons/ ac)		Increase cf. non-grafted	Soluble solids (°Brix)		Color		pH	Red	Pink	Green	Sun-burn	Mold	BER
DRI 319	Maxifort	62.6	b	26%	5.10	d	21.1	ab	4.54	81.3	1.9	4.9	3.2	8.1	0.5
DRI 319	Multifort	56.9	bc		5.43	cd	20.9	bc	4.51	87.2	0.4	4.6	3.7	3.9	0.1
DRI 319	Non-disclosed	50.4	c		5.75	bc	20.9	bc	4.51	83.8	0.6	4.4	5.2	4.8	1.2
DRI 319	non-grafted con-trol	49.8	c		5.70	bc	21.0	ab	4.49	81.0	1.5	5.0	6.3	5.3	0.9
HM 3887	Maxifort	79.6	a	55%	5.13	d	21.0	ab	4.51	84.7	1.9	8.6	1.4	3.2	0.2
HM 3887	Multifort	77.74	a	51%	5.08	d	21.1	ab	4.48	80.3	2.5	9.3	1.9	5.1	0.9
HM 3887	Non-disclosed	52.57	bc		6.30	a	20.4	c	4.49	81.9	1.5	7.2	3.6	3.1	2.6
HM 3887	non-grafted con-trol	51.33	c		6.00	ab	20.9	bc	4.45	77.6	2.2	9.1	5.2	3.3	2.6
N 6428	Maxifort	86.38	a	50%	4.30	e	21.5	a	4.52	90.3	1.6	3.7	0.9	2.4	1.0
N 6428	Multifort	80.75	a	40%	4.60	e	20.9	bc	4.49	90.9	1.3	3.3	1.2	1.4	1.9
N 6428	Non-disclosed	60.85	bc		5.33	cd	20.4	c	4.47	84.7	1.1	2.3	2.6	1.9	7.4
N 6428	non-grafted con-trol	57.73	bc		5.15	d	20.6	bc	4.50	82.6	1.6	3.3	4.3	1.5	6.8
	Mean	63.89			5.32		20.9		4.50	83.9	1.5	5.5	3.3	3.7	2.2
	LSD	11.20			0.45		0.6		ns						
	P value	*<0.0001*			*<0.0001*		*0.040*		*0.508*						
	CV (%)	*12.182*			*5.85*		*2.05*		*1.00*						

Values represent the average of four observations. Values in the same column followed by the same letter are not significantly different.

	Yield (tons/ ac)	Increase cf. non-grafted	Soluble solids (°Brix)	Color	pH	Red	Pink	Green	Sun-burn	Mold	BER
<u>GROUP CON-TRASTS</u>											
Grafted	67.53	27%	5.22	20.90	4.50	85.0	1.4	5.4	2.6	3.8	1.7
Non-grafted	52.96		5.62	20.83	4.48	80.4	1.8	5.8	5.3	3.4	3.4
Contrast P value	*<0.0001*		*0.0006*	*ns*	*ns*						

Evaluation of Nitrogen Stabilizers for Improving Corn Yield and Plant Nitrogen Status

Nitrogen (N) is part of a balanced, natural cycle in the environment among the atmosphere, soil, plants, animals, and water. Nitrogen is the most important element needed by crops, and we often add nitrogen fertilizer to optimize crop productivity. Nitrogen use in agricultural systems must be reported for regulatory compliance under the Irrigated Lands Regulatory Program and the Dairy Order to help ensure that a greater fraction of the applied N is recovered in the harvested crop and not lost to the environment. Nitrogen management gives consideration to the four R's:

- Right source: matching fertilizer source with crop need,
- Right rate: applying the right amount based on crop need and nutrient availability through other sources,
- Right time: applying the nutrient when the crop can use it,
- Right place: fertilizer placement that optimizes the crop's ability to use it.

The four R's address management considerations (e.g. fertilizer program, irrigation), but site characteristics (e.g. soil, cropping system, weather conditions) also influence N recovery in the crop. Also important to improving crop N recovery is understanding barriers to adopting best management practices, such as costs or risks to crop quality or yield.

While the four R's articulate four principles for N management, the N cycle in cropping systems is complicated. Nitrogen can be introduced and lost by various paths. We generally add N with organic matter amendments – such as crop residues, compost, or manure – or with fertilizer. While organic matter amendments must be mineralized before the N is available for plant uptake, fertilizer N is readily available for plants to use. That said, plants generally take up N at different stages during their life cycle, and there is a risk for N loss if the N is applied or becomes available when the plants do not need it.

Technologies have been developed to mitigate N losses from cropping systems. These technologies are collectively known as enhanced efficiency fertilizers (EFF) and include additives, physical barriers, and chemical formulations that stop, slow down, or decrease fertilizer losses. Nitrogen stabilizers are one example and are fertilizer additives intended to improve crop N use efficiency and reduce N losses to the environment by interrupting the microbial processes that change N to its plant-available forms. We developed a trial to evaluate two N stabilizer products with the objective of determining whether the treatments improved corn silage yield or plant N status compared to fertilizer alone. We did not attempt to measure N losses from the system (e.g. leaching, denitrification), as these are very challenging to quantify.

The trial took place in San Joaquin County on a DeVries sandy loam soil. The field had a winter wheat crop that was cut for forage in the late spring. Dry manure was applied to the field between wheat harvest and corn planting, which occurred on May 24, 2018. At-planting fertilizer provided approximately 12 lb N per acre (4-10-10). Sidedress fertilizer application occurred on June 21st, and provided approximately 105 lbs N per acre (UAN 32). Four treatments were applied at sidedress, when plants were at V3-4 stage of development. The N stabilizers were applied at the label rates, and the treatments were: 1) Vindicate (Corteva Agriscience) at 35 fluid ounces per acre, 2) Agrotain Plus (Koch Agronomic Services) at 3 pounds per acre, 3) combination of Vindicate and Agrotain Plus at aforementioned rates, and 4) fertilizer-only, no stabilizer product ("untreated"). Plots were 35 feet across (i.e. fourteen 30-inch rows), in order to adapt to equipment of different widths, by 900 feet long. Treatments were randomly applied in three replicate blocks. Aside from the treatments, the trial was managed by the grower in the same manner as the field. Leaves were sampled at R1 (i.e. silking) for N analysis; we sampled leaves one-below and opposite the earleaf. Harvest occurred on September 20th. All fourteen rows were harvested for weight, and a sample was collected at the silage pit for whole-plant N analysis. We used Analysis of Variance to detect differences in treatments. Treatments were considered statistically different if the P value was less than 0.05, or 5 percent.

There were no differences in leaf or whole-plant N status at R1 or harvest, respectively (Table 1). Mid-season leaf N averaged 2.88 percent across treatments, and whole-plant N at harvest averaged 1.12 percent. At mid-season, leaf N from 2.7 to 3.5 percent indicates that the plant has sufficient N to carry the crop to harvest, and at harvest, whole plant N from 1.0 to 1.2 percent indicates that the N fertilization program was adequate for maximizing yield. Thus, it appears that the field was never deficient in N. There were also no differences in silage yield or dry matter (DM) among treatments (Table 1). Calculated to 30 percent DM, average yield across treatments was 38.8 tons/acre, and dry matter was 35 percent. The low coefficients of variation, which is a measure of variability in relation to the mean, indicate low variability among replicates for plant N status, yield, and DM.

Table 1. Plant N, yield, and dry matter (DM) results for the 2018 N stabilizer efficacy trial. There were no significant differences among treatments.

Treatment	Midseason (R1) Leaf Total N (%)	Harvest Whole Plant N (%)	Yield at 30% DM (tons/acre)	DM (%)
Vindicate	2.97	1.12	40.4	0.37
Agrotain Plus	2.97	1.11	37.7	0.34
Vindicate and Agrotain Plus	2.71	1.16	38.7	0.34
Untreated	2.87	1.09	38.3	0.35
Average	2.88	1.12	38.8	0.35
Coefficient of Variation (%)	4	2	3	3
P value	0.32	0.18	0.48	0.20

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In summary, N is part of a balanced, natural cycle in the environment and is the most important nutrient in cropping systems. Giving consideration to N management will help ensure that a greater fraction of the applied N is recovered in the harvested crop and not lost to the environment, and keeps growers in regulatory compliance. Enhanced Efficiency Fertilizers, such as N stabilizers, have been shown to improve crop yield in regions like the Midwest and the Northeast, and may help to mitigate N losses from the environment. In our trial, we evaluated the efficacy of N stabilizer products for improvements in corn silage yield or plant N status compared to fertilizer alone. Under the management and environmental conditions of this trial, we found no differences in yield or plant N status; however, tests indicated that N was never limiting in the trial. Future study should test these products using different N sources and management practices. Further study may indicate crop or environmental benefits, such as reduced leaching or greenhouse gas emissions.

This trial was made possible with the generous cooperation of Hank Van Exel and Van Exel Farms; Carl Bannon and Steven Colbert (Corteva Agriscience); Brad Schrenk (Simplot); Eric Ellison (Koch Agronomic Services); Nick Clark (UCCE farm advisor); and Shirley Alvarez, Cheryl Gartner, and Dan Rivers (UCCE technicians). An in-depth report will be available on my website (https://ucanr.edu/sites/deltacrops/Corn/) in the near future.

Michelle Leinfelder-Miles, Delta Farm Advisor

Research Roundup: Almond Hull Usage on California Dairies

We surveyed members of the California chapter of the American Registry of Professional Animal Scientists (ARPAS) to better understand almond hull usage in dairy rations.

Why almond hulls? California almond production for 2018 is estimated to be 2.3 billion pounds of kernels (nuts). On average, crop yield is made up of 27% nuts, 19% shells, and 54% hulls. For the 2018 crop, that will translate into 4.6 billion pounds of almond hulls, much of which will be fed to dairy cattle. The acreage of almond orchards is increasing, so the future is for more and more almond hulls to be produced. Anatomically, if you think of a peach, the flesh part of the peach that is eaten is the hull of the almond. Almond hulls are low in crude protein, but they are high in sugar, which makes them an excellent source of energy for lactating dairy cattle. We are working with the California Almond Board to evaluate the quality of almond hulls produced in California, as well as how much can be fed in lactating cow diets.

An electronic survey was emailed to the entire California ARPAS membership list. Forty-two surveys were returned by 40 nutritionists and two feed suppliers. Total number of potential returned surveys is hard to gauge, as an unknown percentage of ARPAS members do not formulate rations. Selected results are presented in Table 1.

Table 1. Amount of almond hulls fed in lactating cow rations.

	Avg. lbs/day/cow	Maximum lbs/day/cow	Maximum % a. hull in diet
Minimum	1	2	0.8
Maximum	10	18	30.0
Average	5.1	10.2	15.3
STD	1.6	2.9	5.8

The majority of respondents considered almond hulls both a forage and concentrate (n=30), as compared with solely a forage (n=12) or concentrate (n=0). How almond hulls were viewed in the ration did not change when asked about different breeds (Holstein vs. Jersey). When formulating growing rations, almond hulls were treated as both a forage and concentrate (n=26), compared with solely a forage (n=12) or a concentrate (n=4), and responses were similar for dry cow rations (both = 26, forage = 13, concentrate = 3). Most respondents (62%) said that changes in almond hull price affected how the hulls were used in the ration formulations.

Sixty-seven percent of respondents expressed concerns when feeding almond hulls to lactating cows; the most commonly expressed concerns were quality related to the amount of stick and shell contamination. This contamination contributed to concerns about consistency of the hull product. Only 20% of respondents did not test almond hulls, while frequency of testing for the remaining 80% varied from every load, to once a year, to only when problems arise. You will hear more about our almond projects in future issues of the California Dairy Newsletter. You can find that newsletter at http://cestanislaus.ucanr.edu/news_102/Dairy_Newsletter/

Jennifer Heguy, Dairy Advisor
San Joaquin, Stanislaus, and Merced Counties

Jed Asmus, January Innovations Inc.
Ed DePeters, UC Davis Department of Animal Science

Announcements / Calendar of Events

Principles of Fruit and Nut Tree Growth, Cropping and Management
February 25 to March 7, 2019
For more information, please visit:
http://fruitandnuteducation.ucdavis.edu/education/principles/
Please contact fruitsandnuts@ucdavis.edu or 530-752-4279 with questions.

***Please see attached flyers for additional events.**

66th ANNUAL OAKDALE LIVESTOCK FORUM

REGISTRATION FORM

Thursday, March 7, 2019

9am—12pm

Gene Bianchi Community Center

110 South Second Street

Oakdale, CA 95361

Name:____

Address:____

____

Daytime Phone: (___) ____________________ Number Attending____________________

Refreshments and lunch will be provided to all participants.

Please return this form with payment of $10.00 for each participant. Enclose a check or money order payable to U.C. Regents. Payments & Registration are due by March 1st, 2019 (or pay $15.00 at the door). This meeting is sponsored by the University of California Cooperative Extension, the California Beef Cattle Improvement Association and the Calaveras, Tuolumne and San Joaquin/Stanislaus Cattlemen's Associations.

Mail registration to:

Theresa Becchetti, Livestock Advisor

U.C. Cooperative Extension

3800 Cornucopia Way, Suite A

Modesto, CA 95358

(209) 525-6800

A Calaveras, San Joaquin, Stanislaus & Tuolumne Counties educational program

Attendees may request meeting accommodations by contacting our office at (209) 525-6800 at least 48 hours prior to events.

Agenda

9:00 am **Registration and Morning Hospitality**

9:15 am **Welcome, Opening Remarks**

9:20 am **Not All Grasses are Equal**
Theresa Becchetti, UCCE Stanislaus and San Joaquin Counties

9:45 am **Genetic Improvement of Beef Cattle: Current Practice and Future Prospects"**
Alison Van Eenennaam, UC Genomics Specialist

10:30am **Vaccinations/Mineral supplement**
Gaby Maier, UC Davis Vet Med

11:15am **Livestock and Greenhouse Gasses – How bad is it?**
Frank Mitlohner, UC Davis

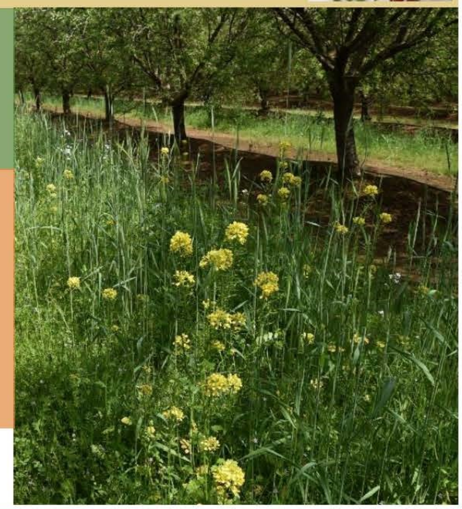
12:00pm **Lunch: Conclude with Beef Lunch *Prepared by the Mid Valley Cowbelles***

Almond Orchard

Cover Crop Field Day

Date: March 21st, 2019   Time: 9:30 AM - 12:30 PM

Location: 7250 Fox Rd Winton, CA, 95388



Curious about cover crops in almond orchards? Join UCCE Merced and UC Davis for an informative field day about maximizing the benefits of cover crops in almond orchards.

AGENDA

9:30 AM – 10:45 AM

Project Overview
Dr. Amélie Gaudin, UCD

Soil Health and Soil Food Web
Cynthia Crézé/ Dr. Amanda Hodson, UCD

NOW management
Dr. Houston Wilson/Dr. Kent Daane, UCR/UCB

10:45 AM – 11:00 AM

Break + Machinery and Seed Mix Exhibit

11:00 AM - 12:30 PM

Bee health and habitat
Dr. Neal Williams, UCD

Orchard water dynamics
Dan Munk, UCCE

Nematode suppression
Dr. Andreas Westphal, UCR

Weed suppression
Dr. Brad Hanson/Steven Haring, UCD

RSVP at:
https://tinyurl.com/yb2ux6c4
For more information, contact:
Sequoia Williams
srwilliams@ucdavis.edu

UC CE

california almonds
Almond Board of California

University of California
Agriculture and Natural Resources
Cooperative Extension

WESTERN SARE
Sustainable Agriculture Research & Education

California Climate Investments
Cap and Trade Dollars at Work

cdfa
CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

UCDAVIS
DEPARTMENT OF PLANT SCIENCES

Exhibits

- Machinery - Learn cover crop management techniques
- Different seed mixes

Approval for PCA & CCA credits pending

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Cooperative Extension
San Joaquin County

2101 E. Earhart Ave., Suite 200
Stockton, CA 95206-3949

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Notes from the Field

February 2019