Field Notes
San Joaquin County
February 2017

University of California
Agriculture and Natural Resources

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Grass Tetany

While all of the rains we have been receiving have been a blessing after years of drought, the current weather conditions also increase the likelihood of grass tetany (hypomagnesemic tetany), a metabolic disease affecting ruminants (cattle and sheep primarily). The most important condition that causes grass tetany is low blood magnesium concentrations, and there are many different situations that can cause low magnesium in cattle. To start, rapidly growing grasses often are low in magnesium. In addition, grasses are high in potassium, which interferes with the absorption of magnesium in the gut. Now we have two strikes against us. High crude protein content of grasses is also of concern. Ammonia can interfere with absorption of magnesium in both the plant *and* the animal. Ammonia fertilizer can decrease magnesium in grasses while increasing crude protein. In the digestive system, ammonia can block the absorption of magnesium, as does potassium. Lactation not only increases the animal's requirement for calcium, but also magnesium. Heavier milking cows are at a higher risk.

It is not uncommon to find dead cows before you realize there is an issue. If there are signs of a struggle, such as grass and dirt moved away from their feet and head, this can help lead to a diagnosis of grass tetany instead of a poisonous plant or other disease, such as Redwater. A necropsy can be performed to positively identify the cause of death by collecting the fluid within the eye. This is the only place in the body that does not increase in magnesium concentrations near death, and therefore, is the one location needed to be sampled. Contact your vet as soon as you find a dead cow to determine the best procedure(s) for conducting a necropsy. If cattle are found alive, they may be weak, disoriented, have convulsions, or attack people or inanimate objects. Keeping these animals calm is important to prevent the convulsions that will lead to death. Intravenous solutions of magnesium and calcium need to be administered to live cattle determined to have grass tetany. Cattle should be moved to an area where alfalfa hay and magnesium and calcium supplements can be given while monitored for relapse. For downed animals, two ounces of magnesium chloride or magnesium sulfate (Epsom salt) in a 200 mL warm water solution can be given as an enema. Blood magnesium levels can increase after 20 minutes. As with any treatment, you should discuss with your vet the different treatment options.

Prevention is the best course of action for grass tetany. Salt-mineral mixes of molasses supplements are the most common methods. Beet molasses is high in magnesium and is normally a large percentage of molasses made in the west. You should read the labels closely and if the supplement contains urea, it may not help prevent grass tetany, since urea breaks down easily in the rumen to ammonia. Homemade recipes can work just as well, such as a one-to-one proportion of magnesium oxide to dried molasses, offered free choice, or one-to-one-to-one-to-one proportions of magnesium oxide, salt, dicalcium phosphate, and corn meal (cottonseed meal or soybean meal can work, as well) fed at a rate of four ounces per head per day minimum. Corn meal can be increased if cattle are not eating enough. The goal is to supplement one ounce of magnesium oxide and one ounce of dicalcium phosphate per head per day. So, the saying "an ounce of prevention is worth a pound of cure" definitely applies here.

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

Sorghum Seeding Rate Trial - 2016 Results

This article summarizes the first year of results from a sorghum seeding rate trial conducted in the Delta. The detailed report is available from my website (http://ucanr.edu/sites/deltacrops/Corn/). The purpose of this trial was to better understand optimal seeding rates for grain sorghum grown in the Delta. The trial was planted on Tyler Island in Sacramento County, on a Rindge mucky silt loam. The plot was planted on May 20, 2016 using a John Deere cone planter. Seed was planted approximately 2 inches deep. The trial was a white sorghum variety, Eureka Seeds 3292, which was the grower's variety. The variety has 16,000 seeds/lb and 85 percent germination, according to the label. Five seeding rate treatments (5, 6, 9, 12, and 15 lbs/acre)

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were replicated over four blocks positioned down the rows. The seeding rates are expressed as plant populations in Table 1. (The number of sorghum seeds/lb is highly variable across varieties. For this reason, when determining seeding rates, growers should first determine their desired plant population. A worksheet for calculating seeding rate from desired plant population is available in the full report.) Each plot consisted of four rows (30-inch row spacing) that were 45 feet in length. The previous crop in the field was wheat. Subsurface irrigation by "spud ditch" was employed twice. The field was fertilized at planting with 35 gallons/acre of 8-24-0 with ½ percent of zinc. The field was cultivated one time, and Maestro 4EC (8 oz/acre), AAtrex 4L (0.75 pint/acre), and Crosshair (4 oz/acre) were applied for post-emergence weed control in mid-June. The plot was harvested on November 14, 2016 using an Almaco research combine, harvesting the center two rows from the four-row plots.

Trial results are presented as plant establishment characteristics (Table 1), plant maturity characteristics (Table 2), and yield (Figure 1). The tables and figure present mean values for the four replicates. Tukey's range test was the statistical method used to compare the means. Varieties were considered statistically different if their P value was less than 0.05, or 5 percent. Differences between treatments are indicated by different letters following the mean.

The estimated plant populations for the treatment seeding rates were calculated using the number of seeds/lb and percent germination for this variety. Stand counts were made as the number of plants/10-foot row length on June 1st and June 16th, and these counts were scaled up to plants/acre. Stand counts were as expected - higher counts for the higher seeding rates. Stand counts for all treatments decreased from June 1st to June 16th, but stand counts remained on target with the estimated plant population for the 5 and 6-lb seeding rates. Weeds were also counted in the month after planting and in the month before harvest (data not shown), but overall weed pressure was very low at this location.

There were no differences in the number of days to flowering among treatments; however, there were differences among treatments in the other maturity characteristics. The higher seeding rate plots had taller plants with longer panicle exsertion (the length of the stem from the top leaf to the bottom of the panicle), which may suggest that at these higher densities, plants were competing with each other and growing taller. Panicles were longest in the 5-lb seeding rate and statistically longer than the panicles in the 12-lb and 15-lb rates. There were no statistical differences in grain moisture at harvest.

The treatment yields do not provide a clear take-home message of the results, except perhaps to show that the highest seeding rate (15 lbs/acre) is not an optimum seeding rate. However, if the 9-lb treatment was ig-

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Table 1. Plant establishment characteristics of the 2016 UCCE Delta sorghum seeding rate trial.

Seeding Rate (lbs/acre)	Estimated Plant Population (# seeds/acre)	Stand Count 1-June (plants/acre)	Stand Count 16-June (plants/acre)
5	80,000	82,756 e	79,489 e
6	96,000	106,712 d	96,258 d
9	144,000	149,396 c	130,667 c
12	192,000	196,436 b	161,156 b
15	240,000	248,267 a	190,338 a
Treatment P value		<0.0001	<0.0001
Standard Error		4432	3748

Table 2. Plant maturity characteristics of the 2016 UCCE sorghum seeding rate trial in the Delta.

Seeding Rate (lbs/acre)	Days to Flowering (# of days)	Plant Height (inches)	Panicle Length (inches)	Panicle Exsertion (inches)	Moisture (%)
5	71	53.1 b	11.8 a	6.2 c	18.2
6	71	52.3 b	11.0 abc	6.7 c	18.0
9	71	54.7 a	11.1 ab	7.4 bc	17.2
12	71	53.4 ab	10.6 bc	8.1 ab	17.8
15	71	53.7 ab	10.3 c	9.1 a	18.1
Treatment P value	0.9014	0.0003	<0.0001	<0.0001	0.0589
Standard Error	0.4	0.8	0.3	0.4	0.22

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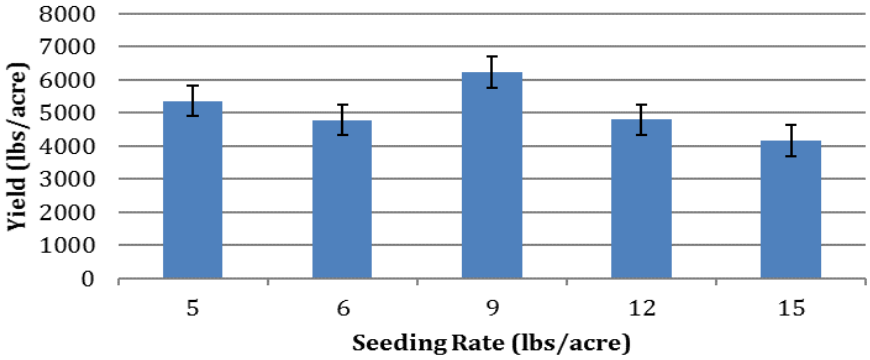
nored, there would be a trend for yield to decrease as the seeding rate increased. A possible explanation for the high yield of the 9-lb treatment is that there were three of these plots proximal to the sub-irrigation ditches, which were exterior to the experiment on both sides. The 9-lb treatment may have been inadvertently favored with better moisture conditions as a result of the experimental design. In hindsight, the experiment should have been blocked across the rows instead of down the rows to account for these field conditions which may have introduced variability in soil moisture. Blocking down the rows accounted for very little unexplained variability, and in future years, the experiment will be designed to account for the variability across the rows.

Figure 1. Yield at 13 percent moisture of the 2016 UCCE sorghum seeding rate trial in the Delta. There were no statistical differences among treatments (P = 0.1278).



In summary, it is important to study sorghum cultural practices in the Sacramento-San Joaquin Delta region because crop acreage appears to be increasing, and the Delta is a unique growing region of California. Sorghum seeding rates as a function of plant population were studied to assist growers with determining optimum rates for the Delta environment. While results are somewhat inconclusive, there appears to be a trend for the lower seeding rates to yield the highest. If this trend is shown in future years, then Delta growers could have higher productivity with lower seed costs.

Michelle Leinfelder-Miles, Delta Farm Advisor

The Water Use Classification of Landscape Species: Finding Low-Water Plants for the Garden

After years of having to be conservative in your water use, you may be thinking about changing out some of your thirstier garden plants for more low-water use alternatives. Nurseries are now carrying much larger selections of these plants, but not always things that are good for our area. So, how ***do*** you find out which plants to use for a low-water landscape in the Central Valley? UC ANR now hosts an easy-to-use online database to help you answer that question. Known by its acronym, WUCOLS, the Water Use Classification of Landscape Species website has a list of virtually every ornamental landscape plant grown in the state of California organized by plant type and water use category.

http://ucanr.edu/sites/WUCOLS/

You can search by any incorporated town or city in California. If you know either the botanical or common name of a plant, you can look up what water use category it falls into: High, Moderate, Low or Very Low. Alternately, if you want to make a list of plants to group together by water use (hydrozoning) for more efficient irrigation, you can choose the type(s) of plants and the water use category, and the database will return a list

Sollya heterophylla, low-water shrub/vine

which you can export to an Excel spreadsheet. For example, below is a list generated for low water vines for Tracy. Similar lists could be made for shrubs, trees, perennials, and/or specifically California native plants.

Botanical Name	Common Name
Bougainvillea spp.	bougainvillea
Campsis spp.	trumpet creeper
Cissus antarctica	kangaroo vine
Clematis lasiantha	pipestem clematis
Fallopia baldschuanica	fleeceflower
Gelsemium sempervirens	Carolina jessamine
Lonicera hispidula	California honeysuckle
Lonicera periclymenum	flowering woodbine
Macfadyena unguis-cati	cat's claw
Rosa "Cecile Brunner"	Cecile Brunner rose
Rosa banksiae	Lady Banks rose
Sollya heterophylla	vining bluebell
Vitis 'Roger's Red'	Roger's Red grape
Vitis californica	California wild grape
Vitis girdiana	desert grape

Karrie Reid, Environmental Horticulture Advisor

Grape Digest—Rainfall, Weeds, and Invasive Pests

A second year of above average rainfall is underway. After four years of drought, soil profiles are saturated, water is accumulating in ways not seen since 1997, and flooding is occurring in many locations.

The total rainfall for the months of October, November and December ended up around 8.8 inches for the North County and well above average for the South County at 6.4 inches. Not since 1998 has it been this wet; that season ended up with 31 inches of rain. Currently, total rainfall stands at about 22.4 inches, compared to a long term seasonal average of 16.9 inches. All of this, and we still have potentially 10 more weeks for rain.

The negative aspects of this much rain include physical damage from flooding, slowed vineyard operations, faster breakdown of herbicides, more weed potential, movement of some soil pests in addition to weeds, excessive vigor of early vine growth, and spring time diseases if cool and/or wet weather continues. The positives of the heavy rains include leaching of accumulated salts, better vine health and strong growth with good yields, reduced costs from less required irrigation, and reduction in the populations of some soil pests, such as gophers, *Phylloxera*, nematodes, and maybe even Vine Mealybug (VMB).

There have been some concerns about VMB resistance and lack of control during the last couple of years, but it appears emergence, population development, dry weather, and spray timings can interact significantly to affect control. In any case, the soils are getting a good flushing. My observations – and those of my predecessor, Jim Kissler – indicate fewer soil pests in wet years.

Chilling hours have been above average, and for a second year in a row, fog has been a more common occurrence as in the "good old days" when the sun often disappeared for three to four weeks at a time. There have been some cold events over scattered areas the previous couple of years to 2016. During the last 10 years, there were some scattered frost events in 2015, 2011, 2009 and 2008. Just to review the old reminder of comparison for soil conditions and cold, to hopefully renew the good luck:

* Firm bare ground, that is wet +2º F
* Firm bare ground, that is dry ---
* Freshly disked soil -2º degrees colder
* High cover crop (24 to 30 inches) 2º to 4º (possibly 6 to 8º colder)
* Low cover crop (less than 24 inches) -1º to 3º degrees colder
* Mowed cover crop -½º F

Weed growth seems to be getting into rapid phase as spring approaches. Good weed control should hold up but may require some extra attention as the weather warms up. There are some newer materials available, making for more choices. Combination and rotation of herbicides for particular weed species continues to be important and should be considered. If you have related questions, check in at www.ipm.ucdavis.edu or www.wric.ucdavis.edu.

As spring and budbreak approach, it appears the Brown Marmorated Stink Bug (BMSB) continues to spread. Keep an eye out for aggregations of unusual stink bugs near structures and protected areas. The Virginia Creeper Leaf Hopper (VCLH) is here, but it does not have a significant presence and can be controlled by aggressive

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Lodi Seasonal Rainfall 2001-2017 (in)

	Total	% Avg	Oct, Nov, Dec	Jan	Feb	Mar	Apr	May	Jun
2001	16.6	98	3.6	3.7	3.7	1.9	3.7	0	0.1
2002	16.3	96	9.7	2.0	1.0	2.5	0.2	0.9	0
2003	15.2	90	8.7	0.6	4.7	1.1	0.1	0.1	0
2004	15.3	90	9.2	0.6	0.9	0.6	3.6	0.4	0
2005	23.1	136	10.4	3.2	3.3	3.5	1.4	1.3	0
2006	23.4	138	7.1	5.4	1.1	5.2	3.8	0.8	0
2007	12.1	71	4.6	0.3	4.3	0.6	2.3	T	0
2008	13.7	81	4.5	7.3	1.8	0.1	0	0	0
2009	15.1	89	4.0	1.9	5.3	1.9	0.7	1.3	0
2010	19.2	113	6.1	4.5	3.6	1.8	2.9	0.3	0
2011	26.3	155	12.1	1.4	4.1	5.8	0.2	1.4	1.3
2012	12.4	73	3.0	2.9	1.3	3.3	1.9	T	0
2013	15.8	93	11.0	1.6	0.3	2.1	0.6	0.1	0.2
2014	10.2	60	2.2	0.1	4.7	1.9	1.4	0.0	0.0
2015	13.2	78	9.2	0.0	1.9	0.3	1.6	0.1	0.1
2016	17.8	105	3.9	6.2	0.6	5.3	1.3	0.4	0.0
2017	22.4	132	8.8	10.8	2.8				
Average	16.9		6.9	3.1	2.7	2.4	1.6	0.5	0.1

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VMB programs. If leafhoppers become a problem, VCLH may be involved.

The good news is Light Brown Apple Moth (LBAM) is no longer under a quarantine protocol. The other good news is that it is easy to control. It is a Lepidoptera pest very similar to the Omnivorous Leaf Roller (OLR), and it seems to be controlled by our native beneficial insect predators and parasites.

And finally, remember to update your Nitrogen Management Plan, and get self-certified. Check with the San Joaquin County and Delta Water Quality Coalition office if you have any questions. Their contact information is: 209-851-4204 and info@sjdeltawatershed.org; web site www.sjdeltawatershed.org.

An investment in knowledge pays the best interest.
Benjamin Franklin

Paul Verdegaal, Viticulture Advisor

Almond Bloom Disease Control

Almond trees are susceptible to blossom and foliar diseases when it rains at bloom time. Many of these diseases can be effectively managed with properly timed fungicide applications. The fungi that cause these diseases are usually present in almond orchards, depending on the previous year's disease incidence and current environmental conditions.

Not all fungicides are equally effective against all diseases. Growers should assess the diseases present in their orchards and select materials carefully. The UC IPM website provides more information (http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf). To reduce the risk of fungi developing resistance, fungicides with the same mode of action should not be used repeatedly. The Fungicide Resistance Action Committee (FRAC) has categorized fungicides into groups based on mode of action; those in different groups are suitable rotation partners in a resistance management program. When making fungicide applications, keep track of their FRAC numbers, and if possible, make only one application per season from each of the FRAC numbers 1, 3, 7, 9, 11, and 17. After using one of these fungicides, rotate to another number. Don't use the same number for two consecutive sprays.

In El Niño or wet years, growers have observed late-spring and summer diseases such as scab, rust, and Alternaria leaf spot. If rainfall continues into late spring, additional fungicide applications may be necessary. Growers often concentrate their control measures on brown rot sprays at early bloom and often neglect their scab and Alternaria sprays after bloom. 'Monterey' and 'Carmel' are susceptible to scab and should be sprayed at 2-5 weeks after petal fall. 'Nonpareil' is typically sprayed for brown rot at pink bud, but it is a highly disease-resistant variety that in most years only needs a full bloom spray to control brown rot.

Usually two sprays are made for brown rot control. The first is usually done at 5-20% bloom using a systemic fungicide, such as a DMI (FRAC 3) or AP (FRAC 9). The second spray should be done near 80% to full bloom, or 7-10 days after the first spray. This is the most effective brown rot spray. Depending on the weather, a third spray may be necessary for protecting against jacket rot and green fruit rot caused by *Monilinia*, *Botrytis* and *Sclerotinia* species, as well as other diseases if rains persist and two weeks of protection have passed. This application can be with a systemic or a contact fungicide. The risk of resistance is reduced by using a multi-site compound (such as ziram or chlorothalonil).

Application techniques are important. Ground applications are better than air, but care must be taken that both are applied correctly. Use properly calibrated and directed nozzles while spraying, and maintain a slow ground speed (<2.5 mph). The brown rot fungus (*Monilinia laxa*) attacks the tree by invading the stamens and pistils of the flower when it is open (Fig. 1). From there, the fungus can move into and kill the spur or shoot. Young fruit are also susceptible in early spring, and infection of fruit may extend to spurs and shoots. Although all cultivars of almond are susceptible to brown rot, they vary in their susceptibility. 'Nonpareil,' 'Peerless,' and 'Aldrich' are the least susceptible. 'Sonora', 'Fritz', 'Monterey', and 'Carmel' are less susceptible, and 'Butte', 'Wood Colony', 'Mission', and 'Livingston' are some of the most susceptible varieties. Varieties that are susceptible to green fruit rot or jacket rot are 'Butte', 'NePlus Ultra', 'Merced', 'Carmel', 'Price', and 'Wood Colony', or any variety with tight clusters. If bloom is extended and the weather is wet and rainy, no more than ten days should elapse between treatments.

Figure 1. Brown rot fungus (Monilinia laxa)

The shot hole fungus (*Wilsonomyces carpophilus*) is notoriously more prevalent in wet years. This fungus requires water for all of its activities, so periods of extended rainfall create a situation that favors shot hole disease epidemics. The fungus can cause lesions on leaves and fruit, but most of the time it infects the leaves as they emerge from the leaf bud. Leaf infections lead to defoliation, which usually occurs in early spring. Shot hole infections of young fruit, shortly after they emerge from the jacket, can cause the fruit to drop. As fruits enlarge, shot

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hole infection results in a lesion, but the fruit no longer fall. About the first of May, when the embryo of the nut begins to grow, the hull becomes resistant to infection and no further lesions develop. Shot hole is usually controlled by fungicide applications after bloom (when leaves emerge), usually from petal fall to two weeks after petal fall. An IPM strategy for shot hole control is to monitor orchards in the fall and spring for shot hole lesions and fruiting structures. Fruiting structures appear in the center of leaf lesions as small black spots (sporodochia) and can be seen with a hand lens. If fruiting structures are present in leaf lesions in fall, then a treatment the following spring should be applied at leaf emergence. (Sometimes this can be concurrent with bloom.) If fruiting structures are not present, you can hold off the petal fall spray and monitor leaves in the spring for lesions. As soon as fruiting structures are evident, however, apply a fungicide as long as conditions are wet. If fruiting structures are absent, delay treatment until they are present.

Scab (*Cladosporium carpophilum* or *Fusicladium carpophilum*) was initially controlled with the strobilurin or QoI fungicides (Group 11), but resistance to these fungicides has developed and we now recommend not using group 11 fungicides, unless in pre-mixtures or tank mixtures, and in orchards without known resistance. Dr. Jim Adaskaveg has developed a three-spray strategy for scab control that includes a delayed dormant application of copper-oil or chlorothalonil, a two-week after petal fall spray that includes chlorothalonil (Echo, Bravo, Equus; group M5), and a five-week after petal fall spray that includes Captan (group M4), Ziram (group M3), or pre-mixtures of DMI (group 3), SDHI (group 7), or QoI (group 11) fungicides. Ph-D (FRAC 19) can also be used in tank mixtures. Maneb (recently cancelled) can be used until supplies are exhausted. The mancozeb product (FRAC M3) was registered as Manzate in 2012. All of these multi-site mode of action fungicides will have little chance of resistance developing to them.

Recent work by Dr. Adaskaveg also has shown that delayed dormant applications of chlorothalonil and oil are even better than copper and oil at reducing scab inoculum. *Cladosporium (Fusicladium)* causes greasy black spots on fruit, leaves, and green shoots. The shoot lesions are the overwintering sites for the fungus and the source of new spores in the spring. No apparent damage is done to the fruit, but leaves may fall prematurely. Scab can completely defoliate a tree in a short time. All cultivars appear susceptible, but 'Carmel', 'Peerless', and 'Monterey' are especially vulnerable. One of the more complicated aspects for managing this disease is that it is slow to develop, and symptoms apparently develop all at once. When this happens, most growers and PCAs want to start treating; however, it is very difficult to manage the disease at this stage, and use of single-site mode of action fungicides may lead to resistance due to high inoculum levels. Under these conditions only multi-site mode of action materials like sulfur or captan should be used.

An extremely damaging fungal disease, anthracnose (*Colletotrichum acutatum*), can be severe in warm, wet springs, with average daily temperatures above 63°F. We saw a lot of anthracnose in the 2011 El Niño year. On fruit, anthracnose can cause deep crater-like lesions; the affected area turns a rusty-reddish brown. Older fruit often gum profusely, and the nut meat is usually destroyed. A good scab control program will usually control or reduce anthracnose. Orchards that have a history of anthracnose should be treated during bloom, starting at pink bud (with your brown rot spray to protect blossoms), to help reduce inoculum build-up. Ideal conditions for disease are warm rains, and protecting trees before every rain is necessary for ideal control. All cultivars appear to be susceptible to anthracnose. In orchards that have a history of anthracnose, apply fungicide sprays every 10 to 14 days if rains persist after bloom. Late spring rains may necessitate additional applications into May. Alternate fungicides as previously discussed. Pruning out dead, infected wood reduces inoculum. If sprinkler irrigation is practiced, use low-angle nozzles to prevent the tree canopy from being wetted by sprinklers.

Brent Holtz, Almond Advisor and County Director

Announcements / Calendar of Events

Quad-County Walnut Institute
Thursday, March 2, 2017
8:00am-12:00pm
Stanislaus County Ag Center, 3800 Cornucopia Way, Modesto, CA 95358
Contact: Roger Duncan, 209-525-6800, raduncan@ucanr.edu

Vertebrate Pest Conference – sponsored by PAPA
Thursday, March 2, 2107
6:30am-3:30pm
Robert Cabral Agricultural Center, 2101 E. Earhart Ave, Stockton, CA 95206
Agenda available at http://www.papaseminars.com/Images/Seminars/STOCKTONVPCSEMINAR3217_2-3-2017.pdf
Open to the public. $80 for PAPA members and $100 for nonmembers. Lunch provided.
7.5 DPR Hours Requested, Including Laws
Contact PAPA for more details.

Sorghum Silage Meetings
Tuesday, March 7, 2017
10am – 1pm
Madera Farm Bureau Office, 1102 S. Pine Street, Madera, CA 93637
See cestanislaus.ucanr.edu/files/256127.pdf for more information.
Contact: Jennifer Heguy, 209-525-6800 or jmheguy@ucdavis.edu

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Synthesizing New Knowledge on Rangeland Ecosystem Functions and Services
Thursday, April 13, 2017
8:00am-2:00pm
Sierra Foothill Research and Extension Center,
8279 Scott Forbes Road, Browns Valley, CA 95918
Contact: Megan Osbourn, 530-639-8800
Information and registration available at
http://sfrec.ucanr.edu/?calitem=351088&g=62869

Other livestock and natural resources meetings (details to follow):
Oakdale Livestock Forum, Bianchi Community Center, Oakdale, CA
Small Landowner Short Course, Pardee Center
Westside Rancher Meeting, Frank Raines Park, Patterson, CA
Hopland Research and Extension Center Tour
Contact: Theresa Becchetti, 209-535-6800 or tabecchetti@ucanr.edu, or visit http://cestanislaus.ucanr.edu/

Evaluation of Potassium Fertilization for Processing Tomatoes in the North Delta

Potassium (K) is important for vegetative growth, yield and fruit quality, especially color uniformity of tomato fruit. Foliar symptoms of deficiency may include necrotic spots on leaves, marginal leaf necrosis, leaf curling, and premature drying and death of the foliage. As tomato yields increase, crop removal rates will also increase (to the tune of roughly 6 pounds K per ton of fruit). If fertilization levels are below that which is removed in the crop, you may not leave sufficient K to supply future crops, depending on what the soil is able to supply. With buried drip irrigation, the volume of soil the roots explore is limited, and therefore the drip wetted zone can potentially become depleted. With high yields and a limited volume of soil explored, K supplementation may be warranted. In 2016, we conducted a K fertilizer rate trial in a commercial field of the north Delta. Our work built upon work by Gene Miyao, who has been conducting trials in the southern Sacramento Valley over a number of years, looking at applications of composted poultry manure or K fertilizer. We thank Gene and the cooperating grower for their assistance with the trial.

The trial took place on an Egbert clay which is widespread in the Delta. Pre-plant soil testing from within the trial area indicated that soil K levels ranged from 136 to 158 ppm and 1.4 to 1.5% of CEC (varying across the sub-acre trial area). The K (as muriate of potash, KCl) was sidedressed pre-plant at rates of 0, 50, 100, 200, 400 and 800 lbs K_2O per acre. Plots were 80 feet in length, and the treatments were replicated six times. The field was initially irrigated with sprinklers, but later switched to furrow irrigation. Fruit were mechanically harvested, and for each plot, a 5-gallon fruit sample was hand-sorted for culls and maturity. Samples of red fruit were taken to a PTAB inspection station for analysis. We observed a significant linear response of yield to K application rates (see table and chart). While there were statistical differences among treatments for Brix and percentages of pink, mold, and blossom end rot (BER) fruit, these variables were not greatly affected by the fertility treatments.

Brenna Aegerter, Vegetable Crops Advisor

The following are suggestions based on previous UC research:

SOIL AND TISSUE TESTING FOR K. Samples are best taken in late fall or early spring. Soil sampling should be from the top foot and within the drip tape wetted zone (if the field is drip irrigated). Soils with less than 200 ppm K (from an ammonium acetate extraction lab procedure) are likely to show a yield response to K fertilizer. Fields with levels below 150 ppm are especially likely to respond. Another factor to consider is the soil K level as a percentage of cation exchange capacity (CEC) or '% K'. Fields with less than 200 ppm K and also less than 2% K are most likely to respond to K fertilization. Note that soil tests do not capture how efficiently plants acquire nutrients; rooting depth and root density can also affect K uptake. In other words, sometimes soil levels may be sufficient, but soil or disease issues prevent adequate K uptake by the crop. Another important consideration is that there can be significant variation in K levels across a field, so not all parts of a field might respond to fertilization similarly. Preseason soil sampling appears to be a better indicator of K status compared to in-season plant tissue sampling. At first bloom, whole leaf nutrient sufficiency guidelines for K range from 2.2 to 3.5%. By full bloom time, this drops to 1.6–3.1%. At full bloom timing, tissue sampling may be useful to diagnose a problem, but it is too late for a K application to correct a deficiency.

TIMING APPLICATIONS. Uptake peaks at a rate of around 50 lbs K_2O per acre per week at around 10 to 11 weeks after transplanting, but applications should begin well before that. If applying K through the drip line, applications should begin as early as 6 weeks after planting and continue for 4 to 5 weeks. Applications should be finished by 12 weeks after transplanting to be ahead of the bulk of the fruit-sizing period when K demand is high. How large of an application is warranted? Given the uncertainty of a response, a seasonal total amount between 50 and 200 lbs K_2O per acre seems sensible. If fertigating by drip, which we believe is efficient, splitting the application amounts equally makes sense. However, most of the trial work by Miyao has been as a preplant sidedressed application in drip-irrigated fields.

For more on this topic, see:
Soil testing for P and K has value in nutrient management for annual crops. California Agriculture July-Sept 2016.
http://calag.ucanr.edu/archive/?article=ca.2016a0007

Table 1. Impact of K fertilization rate on yield and fruit quality of processing tomatoes, north Delta, 2016. Note that averages followed by the same letter are not significantly different. P values below 0.05 indicate a statistically significant effect of K rate on that variable. NS = not significant

K rate (lb/ac)	Marketable yield (tons/ac)		Soluble solids (°Brix)		color	pH	% pink	% green	% sun burn	% mold	% BER
800	51.0	a	6.12	a	23.8	4.23	1.5	1.2	2.0	2.3	1.0
400	50.9	a	5.97	a	24.0	4.22	2.4	1.9	1.3	4.5	3.0
200	49.3	ab	6.00	a	23.8	4.23	2.1	1.1	2.0	3.5	3.0
100	48.6	bc	5.93	a	23.8	4.24	3.1	2.1	1.4	4.2	3.1
50	48.4	bc	5.72	b	23.8	4.22	3.1	1.2	1.4	3.2	3.0
0	46.6	c	5.94	a	23.9	4.23	2.3	0.7	2.9	2.6	2.5
Average	49.2		5.95		23.9	4.23	2.4	1.4	1.8	3.4	2.6
P value	*0.01*		*0.01*		*NS*	*NS*	*0.032*	*NS*	*NS*	*0.049*	*0.013*
% CV	*3.8*		*2.6*		*2.9*	*0.5*	*34*	*89*	*53*	*37*	*39*

CONTRASTS (*P Values*)

K RATE	Yield	Brix
ZERO K VS ANY K RATE	*0.005*	*NS*
LINEAR TREND	*0.001*	*0.004*
QUADRATIC TREND	*0.037*	*NS*

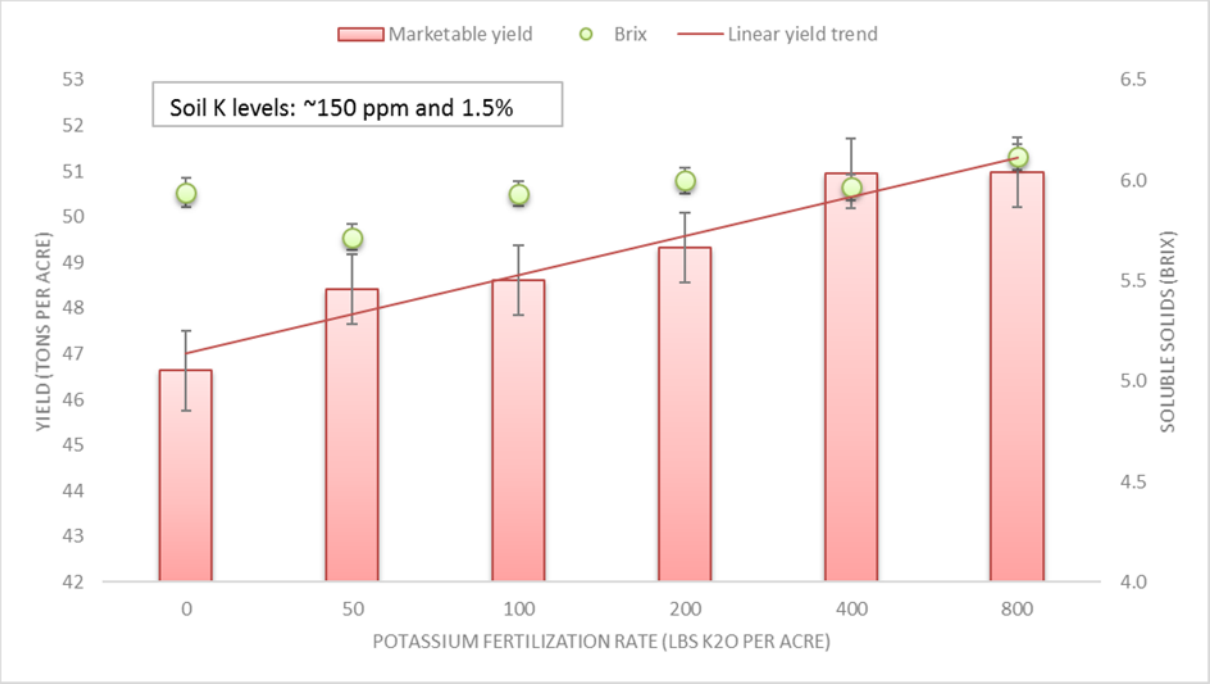

Figure 1. Response of marketable fruit yield and soluble solids (Brix) to potassium fertilization.

San Jose Scale and its Biological Control Activity in the NSJV

San Jose Scale (SJS), *Diaspidiotus perniciosus*, is a pest of several crops, including major fruit and nut crops. SJS has rarely been a problem in California cherries in the past. There has, however, been increased incidence of scale infestations in recent years in the Northern San Joaquin Valley (NSJV). The infestations have been quite severe in some cases, leading to rapid limb dieback, gumming, and tree death within 1-2 years. There are two life stages of scale: the mobile (i.e. first instar nymphs, commonly known as crawlers) and immobile (i.e. white and black cap) stages. Scales suck plant juices from twigs, limbs, foliage, and fruits, resulting in reduced tree growth and productivity. Scale damage on fruits can be identified by the presence of red halos (i.e. depressed areas, or 'dimples') on the fruit surface (Fig 1). Scale infested fruits are unmarketable, especially for the export market. We are receiving reports of severe fruit damage by scales from local PCAs and growers. Previous studies have shown that the parasitic wasps, *Encarsia perniciosi*, *Aphytis aonidiae*, and *Aphytis vandenboschi* are abundant in several tree fruit and nut crops in the San Joaquin Valley (UC IPM guidelines, Daane et al., 2002-Cal. Tree Fruit. Agreement Report) and may provide some control of SJS. It is presumed, however, that insecticide usage for spotted wing drosophila (SWD) control in recent years can reduce populations of these beneficial insects. With this changing scenario of pest management in cherries, we assessed the occurrence and abundance of SJS biocontrol agents in the NSJV. Also, we conducted a SJS phenology (life cycle) study in cherries because the previous information we had was based on work done in almonds.

In 2016, we monitored SJS and its natural enemy activities in 9 cherry orchards in Contra Costa, San Joaquin, and Stanislaus counties using sticky traps baited with the SJS pheromone (for male SJS, and SJS parasites) and double-sided tapes (for scale crawlers).

In Stanislaus County orchards, peak male SJS activity was observed during April (April 4th-20th) in all three sites, while a second peak was observed only in site 3 (not shown). Two parasites, *Aphytis* spp. and *Encarsia* spp. were present in all orchard sites; although, *Encarsia* spp. was dominant during the peak activity period in Spring (first week of April). In general, peak *Encarsia* activity coincided with the spring SJS male peaks in site 1 and site 2 (Fig. 2 shows site 1). Parasite counts remained low after May in all sites, suggesting that SWD sprays may have impacted the natural enemy population. SJS crawler activities were observed in mid to late April, late May to early June, and mid to late August, suggesting potentially three generations per year (Fig. 3).

In San Joaquin County sites, *Encarsia* spp. was more abundant than *Aphytis* spp. in the two sites surveyed. The first two peaks of parasite activity (third week of March, and first week of June) coincided with the peak male SJS activity at Site 1 (Fig. 4). Male SJS activity was only observed in mid-August in Site 2 (not shown). This difference might have been due to the differences in pest management practices between the two sites. On average, the first peak crawler activity was from the first to the third week of April, while the second peak was observed the first week of June (Fig. 5).

In Contra Costa County, peak activity of SJS males was observed during mid-June in two sites (Fig. 6, one of the two sites). In contrast, only a spring peak (mid-March) was observed in the third site (not shown). No male SJS were captured from the fourth site. In contrast to the San Joaquin and Stanislaus sites, *Aphytis* spp. was more abundant than *Encarsia* spp. in Contra Costa sites. Peak crawler activity was observed around the third week of May. No other peaks were observed (Fig. 7), and this might have been due to the relatively low crawler counts from Contra Costa orchard sites overall.

Due to relatively low crawler activity in our sampling sites last year, further work is needed to confirm the crawler emergence timing and number of generations of SJS in the NSJV. This information will help to determine whether crawler treatment (if needed) is possible without interfering with the cherry harvest, which occurs mostly in May. Our study showed that SJS parasites are present in cherry orchards, and they are likely reducing scale populations. These parasites, which keep SJS in check in most orchards, are likely affected by the repeated applications of broad-spectrum insecticides targeting SWD. In this context, it is important to monitor cherry orchards more closely for scale infestations by performing dormant spur sampling and trapping for male SJS during the growing season. Besides attracting male SJS, the traps are useful for assessing populations of SJS parasites. Regular maintenance of the orchard, including dormant (or delayed-dormant) sprays with oil and/or insecticide (insect growth regulators: Seize, Centaur, or other organophosphate and carbaryl insecticides) are essential for SJS management. Attention should be given to select appropriate broad-spectrum insecticides to comply with groundwater protection regulations. Check with your local Ag Commissioner's Office about any local regulations/ restrictions. The UC IPM Guidelines for SJS in cherries is located at http://ipm.ucanr.edu/PMG/r105301111.html.

Jhalendra Rijal, IPM Advisor, San Joaquin, Stanislaus, and Merced counties
Janet Caprile, Farm Advisor, Contra Costa and Alameda counties

Fig. 1. San Jose Scale damaged fruits.

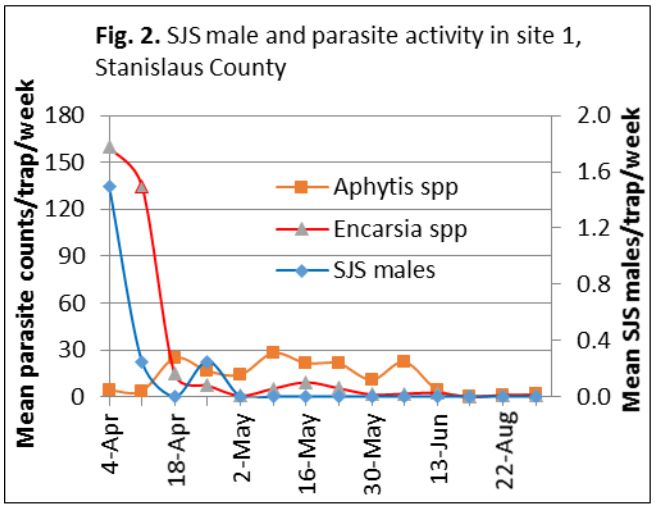

Fig. 2. SJS male and parasite activity in site 1, Stanislaus County

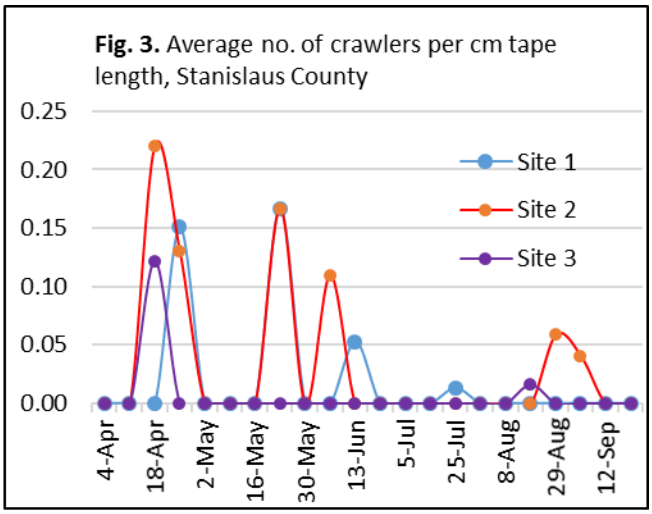

Fig. 3. Average no. of crawlers per cm tape length, Stanislaus County

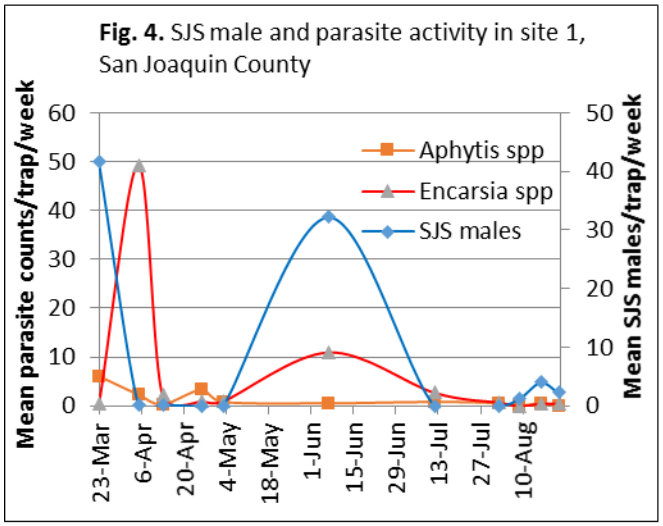

Fig. 4. SJS male and parasite activity in site 1, San Joaquin County

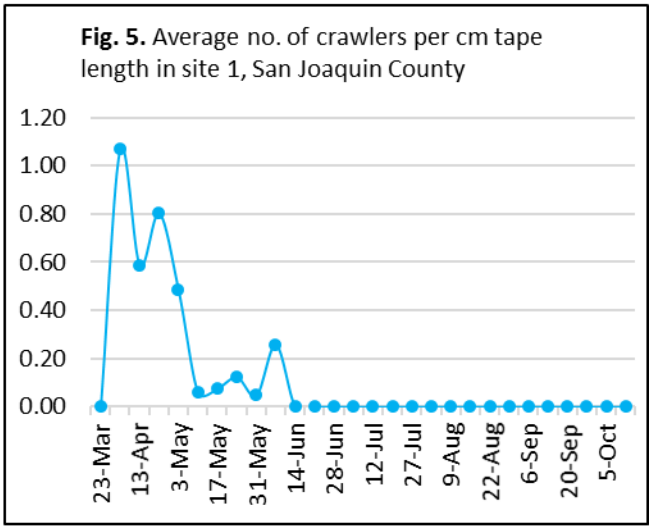

Fig. 5. Average no. of crawlers per cm tape length in site 1, San Joaquin County

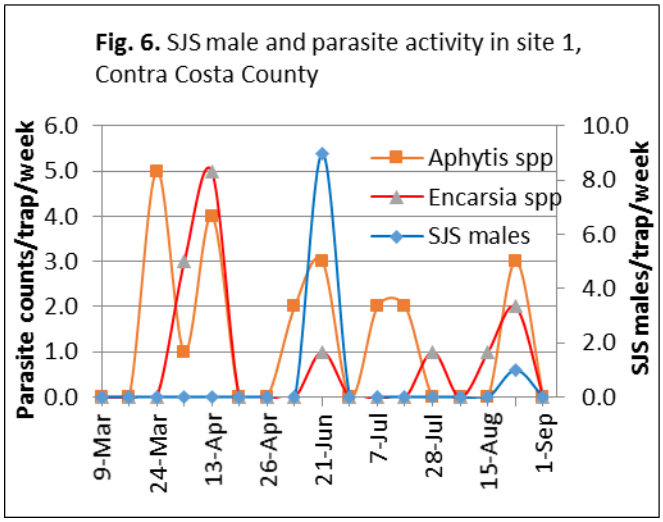

Fig. 6. SJS male and parasite activity in site 1, Contra Costa County

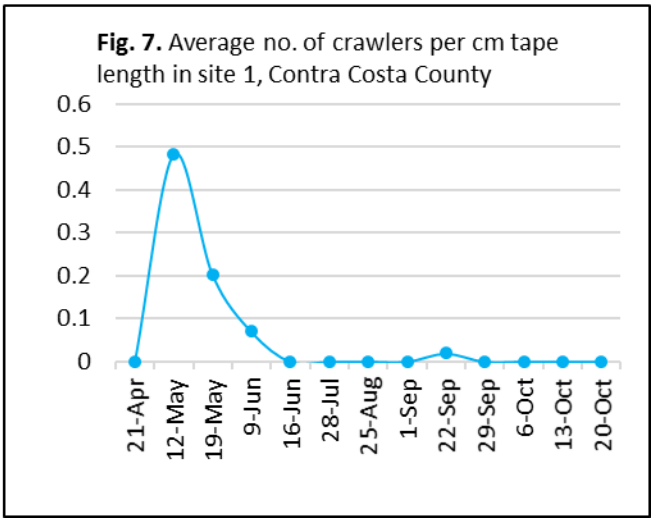

Fig. 7. Average no. of crawlers per cm tape length in site 1, Contra Costa County

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Notes from the Field

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