Field Notes

San Joaquin County
August 2022

University of California
Agriculture and Natural Resources

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Vegetable Disease Update

Most local vegetable fields are still looking very good, although some fields are showing signs of premature decline as harvest approaches. I have visited or received samples from 23 local fields in June and July, and this article serves as a summary of what I have seen in those two months in terms of disease problems.

The milder weather that we had earlier this season was conducive to **powdery mildew of tomato**. Thus, mildew appears to be widespread in San Joaquin County tomato fields as of late July – with mild symptoms in many fields. At some locations, it is more severe, but the more severe disease seems to be mostly in conjunction with other stress factors that are making the vines more susceptible to mildew.

This year we are seeing more **curly top** disease than usual in local tomatoes. I think every field has some amount of curly top, especially along field edges. However, I've only seen a few fields with disease levels high enough to be economically damaging. At this point in the season, we are unlikely to see any new infections, as the beet leafhopper (BLH) vector has moved on. The state curly top control program recently issued a grower alert, but it was about detection of the BLH vector in valley floor roadside vegetation down in the area west of Firebaugh in Fresno County. Note that curly top can also affect peppers and cucurbits, although we generally only see infections in these crops under heavier disease pressure. In this area, the level of disease we see generally doesn't warrant taking measures to try to prevent or control virus transmission, however if you are interested in the options, please give me a call so we can discuss them.

Although there was heavy thrips pressure this spring, and we now have resistance-breaking strains of the virus in this area, the amount of **tomato spotted wilt** is not as bad as I expected. There are, however, small hotspots of the virus in local fields. With the documentation of resistance breaking spotted wilt in this area last year, the formerly resistant varieties are now susceptible, and we need to return to managing this disease with other tools (avoiding risky planting locations and managing weeds and the thrips vector). See https://www2.ipm.ucanr.edu/agriculture/tomato/Tomato-Spotted-Wilt/.

This year was worse for **bacterial canker of tomato** (Figure 1), with five fields in San Joaquin County that I have seen which have confirmed cases of this bacterial disease. While the hotspots in these fields were hit quite heavily, thus far it hasn't spread extensively within the fields, so hopefully the impacts won't be major.

Now that so many processing tomato varieties have resistance to **race 3 of Fusarium wilt**, it is relatively rare to see this disease. However, most of our varieties are susceptible to some extent to the two other Fusarium diseases which can cause a rot of the crown or roots. I have seen both **Fusarium crown and root rot** pathogens in fields recently. Work continues evaluating disease management strategies, including crop rotations and development of quicker diagnostic techniques. I am working on variety evaluation, looking for tolerance to *Fusarium falciforme* (Figure2, pg. 2). We will be sharing variety recommendations this fall. Stay tuned.

Figure. 1. Wilting from bacterial canker.

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Figure 2. Tomato at center with stunting and yellowing from *Fusarium falciforme* foot rot.

I have seen only an occasional tomato plant dying from **southern blight**, but it has been causing some problems in potatoes. This disease overwinters in the soil as sclerotia and has been a very challenging disease to control. The sclerotia seem to survive well between potato crops and attack the potato tubers just prior to harvest, at a time when fungicides cannot be applied. Our research has evaluated the use of ammonium bicarbonate applications and has confirmed its utility in reducing southern blight tuber infections when applied at burndown or at rewetting.

Luckily, I have not seen any **broomrape** this season, but I wanted to mention it so that it remains on our radar. We do not want this parasitic weed to become established here in our tomato fields. For more information on broomrape, please see the CTRI website: http://www.tomatonet.org/branchedbroomrape. Among the resources here are best management practices for harvester sanitation and flyers developed to train farmworkers to spot this "Tomato Enemy #1". I am here to answer your questions about broomrape, and in my role as a UC farm advisor, I provide advice but I do not act in a regulatory capacity.

Despite all these disease observations and warnings of invasive pests, most fields look good, and harvest is underway in many vegetable crops. Good luck with the remainder of this season!

Brenna Aegerter, Vegetable Crops Advisor

Compost Application to Alfalfa

Since Fall 2020, I have been evaluating the effects of applying green waste compost on established alfalfa. The three-year project includes two trials – one in the San Joaquin County Delta and the other in Yolo County – and is a collaboration with Rachael Long (UCCE) and Radomir Schmidt (UC Davis). The project is supported by a CA Department of Food and Agriculture Healthy Soils Program (CDFA HSP) demonstration grant. Our interests are in evaluating whether compost enhances soil carbon and nitrogen storage, improves soil physical characteristics (i.e. improved water infiltration, reduced compaction), reduces greenhouse gas emissions, and/or boosts alfalfa yield.

Compost is decomposed organic matter from plants or animals and may be classified by the carbon-to-nitrogen ratio (C:N). The C:N is the relative amount of carbon and nitrogen in the material. Plant-derived composts (like green waste compost) have a high C:N, and animal-derived composts (like composted manures) have a low C:N. A material with a ratio greater than 30:1 is considered a high C:N material. The ratio is important because it affects microbial metabolic functioning and plant-available nitrogen. Both high and low C:N composts promote soil functioning by increasing soil carbon that is in a form easily accessible to microbes. That, in turn, can improve soil biological activity and physical conditions. With a high C:N material, however, nitrogen may be immobilized ("tied up"), so soil nutrient monitoring is important in order to stave off impacts to crops.

Methods. The San Joaquin County trial is approximately 20 acres, and there is no history of compost application at the site. The soil is a Peltier mucky clay loam that is considered partially to poorly drained. Compost applications are surface-applied in the fall/winter to plots that are two border checks wide (120 ft) and approximately 1000 ft long. Two green waste compost rates – 3 tons/ac and 6 tons/ac – are being compared to the untreated (non-composted) control. The first compost application was made in Fall 2020 following the first cutting season of the alfalfa stand. The second application was made in Winter 2021, and the final will occur in fall/winter 2022. Baseline soil samples were collected at the beginning of the study (October 2020), and annual sampling is done every fall season before compost application. Alfalfa yield is assessed 3-4 times per year by taking quadrat samples from the grower's windrows. Greenhouse gas samples are collected on a monthly basis.

Preliminary results. Yield was measured from three cuttings in 2021, and so far, from two cuttings in 2022. (We anticipate measuring yield from two more cuttings in 2022.) Our preliminary results from these five cuttings indicate that compost can improve alfalfa yield over the untreated control but that a rate of 6 tons/ac does not improve yield over the 3 tons/ac rate (Fig. 1, pg. 3). We are also testing forage quality, and those results will be available in the fall.

I recently held a field day at the trial location. If you were not able to make it, please visit my website for the handouts (https://ucanr.edu/sites/deltacrops/Meeting_Presentations/). The handout "Compost for Soil Improvement in Alfalfa" shows other preliminary results from this trial, including soil carbon and nitrogen and greenhouse gas emissions. In addition, there are handouts describing other organic matter amendments in alfalfa and forages.

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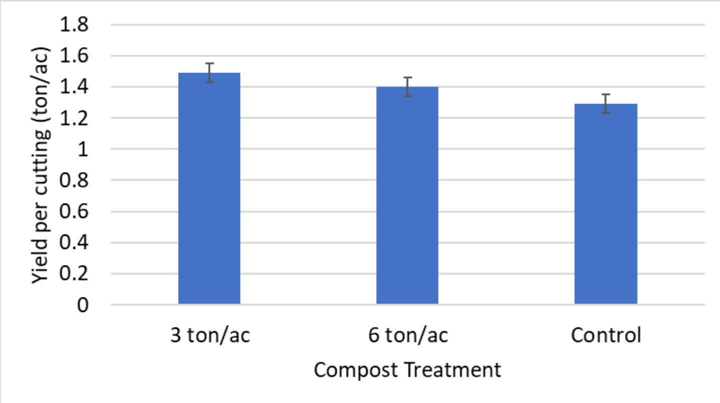

Figure 1. Preliminary yield results over five cuttings in 2021 and 2022. The compost rate of 3 tons/ac improved alfalfa yield over the untreated control.

Conclusions. Organic matter amendments, as from compost, can improve soil functioning, but changes take time to observe, let alone be realized financially. We estimate that compost (material plus hauling) costs approximately $27/ton, with an additional $10/ton for spreading (Fig. 2). To help offset the costs, the CDFA HSP provides incentives grants for farmers (https://www.cdfa.ca.gov/oefi/healthysoils/IncentivesProgram.html), and more funding may be available later this year. UC ANR Technical Service Providers Hope Zabronsky (hzabronsky@ucanr.edu) or Caddie Bergren (cmbergren@ucanr.edu) are available to help growers with the application. And please don't hesitate to reach out to me if you would like more information on this trial or on CDFA incentives programs. Mant thanks to Garrett Mussi for collaborating with us on this trial.

Figure 2. Compost spreading at the San Joaquin County trial. Compost is not a small expense, but it may help improve soil functioning and alfalfa yield over the long-term.

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Newer Insecticides Critical for Spotted Wing Drosophila (SWD) Resistance Management

Background. Spotted Wing Drosophila (SWD), *Drosophila suzukii*, is one of the major pests of sweet cherry in California. The most used insecticides for managing SWD include some pyrethroid and spinosyn products and a few others, including malathion. Insecticides are sprayed several times during the fruit ripening period (color-break stage to harvest) to reduce SWD damage. However, frequent use of these insecticides can result in unwanted outcomes, such as disruption to natural enemies, secondary pest outbreaks such as mites and scale insects, and the risk of pesticide resistance. Recent studies conducted by Frank Zalom's lab at UC Davis suggested that cane berries-collected SWD flies developed resistance to spinosad in coastal California. Similarly, pest control advisers (PCAs) have reported the ineffectiveness of recommended insecticide programs to control the SWD population in some cherry orchards in the northern San Joaquin Valley, creating concern among cherry producers. In this context, exploring various insecticide active ingredients with potentially shorter residues in the fruit is desirable, as they can be used in rotation to minimize the resistance build-up. Herein, we report the results of the studies conducted to evaluate several insecticide active ingredients for managing SWD. The California Cherry Board funded the study.

Laboratory efficacy study protocol. In 2020, we screened several conventional and organic insecticides. Two sets of trials were conducted due to the lack of enough SWD for all the insecticides simultaneously. The first set of trials included eight insecticides (insecticides listed from 1-8 in Table 1, pg. 4) and an untreated control. The second trial contained two insecticides (insecticides listed from 9-10 in Table 1) and an untreated control. All insecticide efficacy bioassays were conducted using the SWD adults from the laboratory colony maintained at UCCE Stanislaus. For these studies, cherry fruit was treated singly with the selected insecticide and hung on the screened lid of the plastic cup (12oz.). Then, 10 SWD flies (age <7 days old) were released into the container to expose them to the treated fruit. Each set of the trial had ten replicates (Fig. 1, pg. 4). The containers were examined for fly mortality at 6, 24, and 48 hours after treatment.

Laboratory efficacy study results. In the first set of trials, there was a significant effect of treatments on fly mortality (F = 79.77, df= 8, 81, P< 0.001). Also, there was a significant effect of treatments on fly mortality (F = 59.25, df= 2, 27, P< 0.001) in the second set of trials. Overall, the laboratory study showed that, in addition to the industry-standard Warrior II (avg. mortality 98%), Exirel (93%), Verdepryn (88%), Minecto Pro (84%), and Pyganic (84%) caused significantly higher SWD mortality than other treatments (P< 0.001) and were highly effective against SWD adults at 48 hours after

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Table 1. List of insecticides used in 2020 SWD trials.

Table 1. Insecticides used to conduct SWD insecticide studies-2020			
SN	***Treatments***	***Active Ingredient***	***Rate/Acre***
1.	Exirel	cyantraniliprole	16 oz
2.	Minecto Pro	cyantraniliprole+abamectin	12 oz
3.	Pyganic 1.4 EC	pyrethrin	2 qt
4.	Venerate	*Burkholderia* spp. strain A396	4 qt
5.	Grandevo	*Chromobacterium subtsugae*	3 lbs
6.	Warrior II	lambda-cyhalothrin	2.56 oz
7.	Erythritol	-	0.5 M
8.	Erythritol + Sucrose	-	(1.5 M) + (0.5 M)
9	Movento	spirotetramat	9 fl oz
10.	Verdepryn	cyclaniliprole	11 fl oz

Figure 1. SWD insecticide evaluation study showing the experiment set up.

after exposure (Fig. 2 and 3, pg. 5). The SWD mortalities for the rest of the insecticides were at par with the control mortality.

Field-aged efficacy study protocol. In the 2021 season, we tested the efficacy of the selected insecticides (Exirel, Verdepryn, Minecto Pro, Pyganic, and Warrior II) based on the 2020-study. The field trial was conducted in a portion of a 5-acre orchard in Stockton, CA, using one tree as an experimental unit and replicated five times. A power backpack sprayer (Stihl SR 200) was used to spray the insecticides after the cherry fruit developed its color. The insecticides were applied at a rate of 100 gallons/acre. At 1 and 7 days after the insecticide application, the cherry fruits were collected, brought to the lab, and tested for adult mortality using the 12 oz. plastic container set-up described earlier.

Field-aged efficacy study results. In the study with fruits exposed to field environmental factors at 1-day after spraying, the insecticide treatments differed significantly with regard to fly mortality (Table 2, pg. 6). At the end of 72 hours, only Exirel and Warrior II caused significantly higher mortality of adult SWD than the untreated control.

Summary

Spotted wing drosophila (SWD) is a significant pest for cherry growers, and having multiple choices of insecticide active ingredients is critical for resistance management. Although the laboratory-based study showed many potential insecticides, the efficacy of most of those insecticides was relatively low under field conditions. Based on a field-the aged residue study, although not statistically significant with control, Verdepryn, a new diamide insecticide, showed some promise for potential fit into resistance management. Most importantly, Exirel showed strong efficacy against SWD flies mainly in field application and can be a strong fit in the SWD resistance management program.

Jhalendra Rijal, IPM Advisor, Northern San Joaquin Valley
Sudan Gyawaly, IPM Advisor, Sacramento Valley

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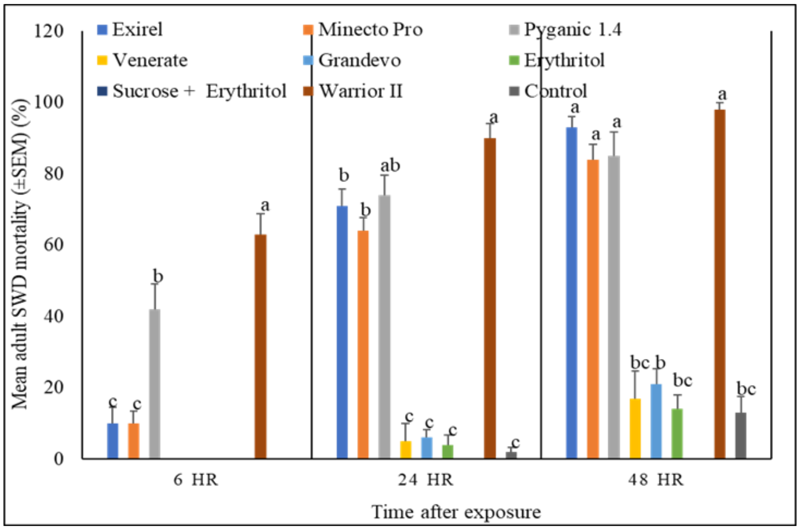

Fig. 2. Effect of insecticide treatments on SWD adult mortality. Means within the same sampling period with the same letters are statistically not different (ANOVA, $p > 0.05$).

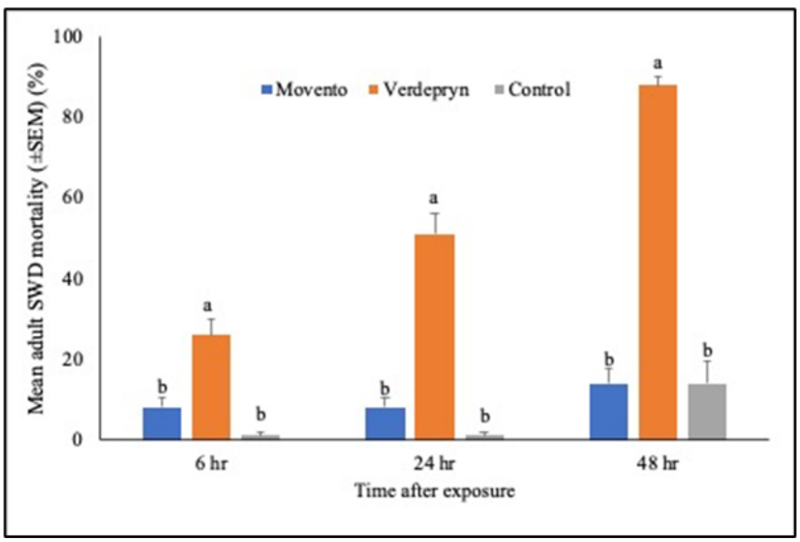

Fig. 3. Effect of insecticide treatments on SWD adult mortality. Means within the same sampling period with the same letters are statistically not different (ANOVA, $p > 0.05$).

Table 2. Adult SWD mortality in sweet cherry fruits exposed to 1 d or 7 d field-weathered insecticide residues in various periods. Means within the column with the same letters are statistically not different.

SN	Treatments	Adult SWD mortality (%) (Mean±SE) on 1-day field-aged insecticide residue on cherry fruits after exposure in the lab			Adult SWD mortality (%) (Mean±SE) on 1-week field-aged insecticide residue on cherry fruits after exposure in the lab	
		24 h	48 h	72 h	24 h	48 h
1	Exirel	8 ± 3.3 a	40 ± 10.1 bc	88 ± 5.2 b	14 ± 4.5	28 ± 5.9 ab
2	Movento	0 ± 0 a	2 ± 1.7 a	4 ± 3.5 a	2 ± 1.7	10 ± 0 a
3	Pyganic	4 ± 2.1 a	8 ± 3.3 a	16 ± 6.0 a	6 ± 2.1	12 ± 1.7 a
4	Verdepryn	8 ± 3.3 a	22 ± 7.6 ab	34 ± 9.2 a	8 ± 5.2	20 ± 7.4 ab
5	Warrior	24 ± 3.5 b	54 ± 7.2 c	76 ± 8.7 b	16 ± 5.3	40 ± 7.4 b
6	Control	0 ± 0 a	0 ± 0 a	4 ± 2.1 a	4 ± 2.1	14 ± 2.1 a
Statistics		$P<0.05$	$P<0.05$	$P<0.05$	$P<0.05$	$P<0.05$

Troubleshooting Dry Matter Results

Sometimes, a dry matter (DM) result just doesn't make sense. What you see in the standing crop, at the silage structure, or in a previous DM determination and the results don't match up. This can happen with samples measured on-farm as well as those sent to a commercial lab. Invest time and troubleshoot to ensure you have good data. Here are a few areas to troubleshoot when presented with potentially inaccurate DM results:

1. Do you have a good sample?

Standing crops

- In corn, for example, avoid sampling within 50 feet of field edges, directly from irrigation borders, or abnormal areas of the field like a sand streak or a low spot where water and nutrient stress are likely to occur.
- Collect at least 10 whole, normal looking corn plants to make one sample. Cut them with a shovel, knife, or machete from the base of the plant at your ideal chop height.
- More than one sample is ideal for understanding how DM varies across your field, such as from the top to bottom of the irrigation or between a split in planting dates due to a delay in sowing to avoid a heat wave.
- How was your sample handled? If the sample is not analyzed immediately, store your sample in a cool, dry place in a sealed plastic bag. Carry an ice chest or refrigerate your sample to store until analyzed.

Silages (and other feedstuffs)

- Is your sample representative of what you'll be feeding? Be sure to take multiple grab samples of the feedstuff. Mix these grab samples in a bucket, and then subsample to analyze for DM.
- For silages, do not take the samples directly from the structure face. Instead, remove the forage from the face (with a front-end loader, for example), move a safe distance from the face, and sample the removed forage. It's best to do this with forage freshly removed from the face.
- How was your sample handled? If the sample is not analyzed immediately, store your sample in a cool, dry place in a sealed plastic bag. Carry an ice chest or refrigerate your samples until they are transported to a lab or on-farm measurements are complete. Minimizing storage time reduces the likelihood of a compromised sample.

2. Is your scale working properly?

- Check the batteries and consider buying an inexpensive calibration weight kit.
- Keep the scale clean and free of debris that can prevent weighing components from working properly.
- Always weigh on a stable, level surface and block the wind.

3. When in doubt – compare!

- Split your sample and run DM multiple times to see if your results are repeatable.

4. Train, train and re-train.

- Having a written protocol for sampling, storing, and analyzing DM on-farm is important to obtain accurate results.
- Check in on the person responsible for measuring DM to be sure he/she understands the protocol, has properly working equipment, and doesn't have any questions or concerns.

Jennifer Heguy, Dairy Advisor, Stanislaus, San Joaquin, and Merced counties
Nicholas Clark, Agronomy Advisor, Kings, Tulare and Fresno counties

Improved Water Management Strategies for Hedgerow Olive Orchards in California

Olive oil orchard acreage has rapidly increased in California within the last two decades. This is due to the increased interest in tree crops that require less water, are fully mechanized, and have a strong domestic market enhanced by a focus on health benefits. The current California olive oil industry is mainly based on the low vigor cultivar Arbequina trained in hedgerow and grown at super high-density (SHD) plantation to allow mechanical harvesting and pruning. Precise management of irrigation is crucial for the economical sustainability of SHD olive systems since it determines oil quantity and quality. However, information on olive water use and efficient irrigation practices for high density systems in California is scarce.

This article briefly presents the on-going research project conducted by Dr. Giulia Marino, an Assistant Professor of Extension in the Department of Plant Sciences at UC Davis and her team. The objectives of this work are: 1) to characterize water use and develop crop coefficients for CA hedge-

Figure 1. Installation of the ET station (top left), of soil moisture sensors (top right), of the irrigation system to apply the deficit (bottom left) and yield data collection (bottom right).

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row olive oil orchards, and 2) to develop protocols to reduce water during drought-tolerant phenological stages without impacting productivity, while improving oil quality.

Why measure olive water use?

The first essential step that growers need to do to implement precise irrigation management is calculate their olive orchard evapotranspiration (ET_{OLIVE}). ET_{OLIVE} is the maximum amount of water that an olive orchard would use if soil water uptake is not limited. If more water than ET_{OLIVE} is applied to an orchard, the extra water will be lost by runoff or deep percolation or can be harmful to the tree in poorly drained soil types. If less water than ET_{OLIVE} is available to an orchard, trees could undergo some level of water stress and reduced productivity. To determine orchard ET of any crop, one can use measurements or computation from weather variables (the reference evapotranspiration (ETo) that can be downloaded from the CIMIS stations across the state) and a crop coefficient (Kc). While for other crops Kc curves have been developed by researchers in California over the years, we still don't have a Kc curve for SHD California olive orchards, and the local practice is to use a constant crop coefficient of 0.75 developed for a traditional, widely spaced Manzanilla table olive orchard.

Why test deficit irrigation?

Deficit irrigation strategies aim to apply less water during specific periods of the season when stressing the trees would have a beneficial effect on orchard profitability and water conservation. Previous research conducted in other countries showed that water stress during olive pit hardening reduces vegetative growth but not fruit growth, resulting in control of canopy growth, a key objective for profitable SHD systems where it results in lower water use and pruning cost. Water stress during pit hardening could increase oil phenolic concentration, a very important oil quality parameter. Finally, knowing how to reduce water application without affecting yield can help maintaining target production in years when water is scarce. Unfortunately, deficit irrigation during pit hardening has not been tested in California so far, which limits the possibility to adopt this strategy more widely.

The experiment:

Two micrometeorological ET stations (Fig. 1, pg. 7) were installed in two similar SHD Arbequina orchards, one located near Corning and one located near Stockton. These stations measure water use of the orchard at an hourly and daily step using the eddy covariance method and residual of energy balance for ET_{OLIVE}. Olive phenology was characterized biweekly to identify the beginning of pit hardening. At pit-hardening (beginning of July), two deficit irrigation treatments were implemented and compared with the grower's standard management (Control). For treatment one, water application was reduced by 20 percent, and for treatment two, water application was reduced by 75 percent. Tree water potential (an indicator of tree water status) was measured using a pressure chamber, to characterize trees' level of stress under deficit.

Some preliminary results:

The crop coefficient of olive during this first year of measurement was not constant but increased during spring reaching maximum values of about 0.7. This corresponds to a weekly water use of 1.0 to 1.3 inches of water per week in the period between June and July. Cumulative water use from April to October was 25 inches. We will keep these measurements over the next several years in order to obtain more robust results to be used commercially and that are representative of different hydrological conditions.

The phenological data show that during pit hardening, between July and August, fruits are not growing, as shown in the fresh fruit weight accumulation graph (Fig. 2A), suggesting that in this period water could be reduced "safely".

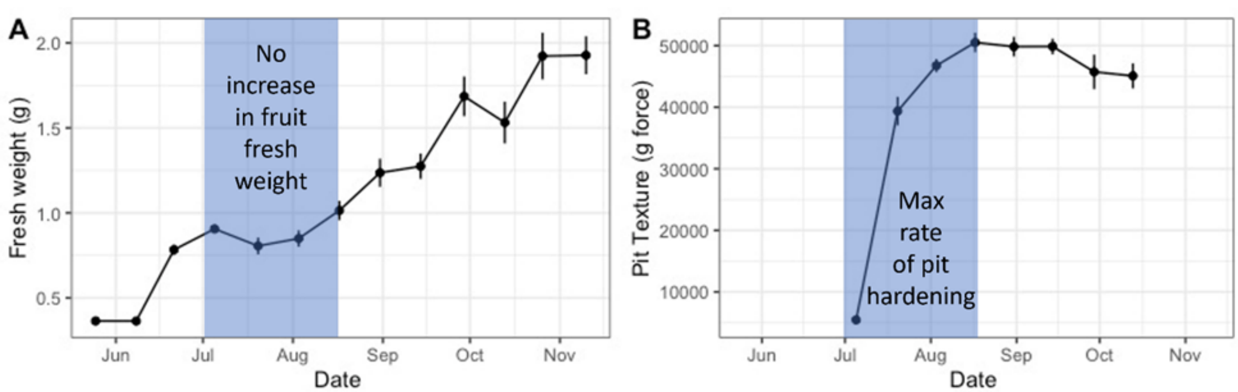

Figure 2. Seasonal evolution of olive fresh weight demonstrating that in the period of pit hardening (July to mid-August), olive fruits are not growing in fully irrigated trees.

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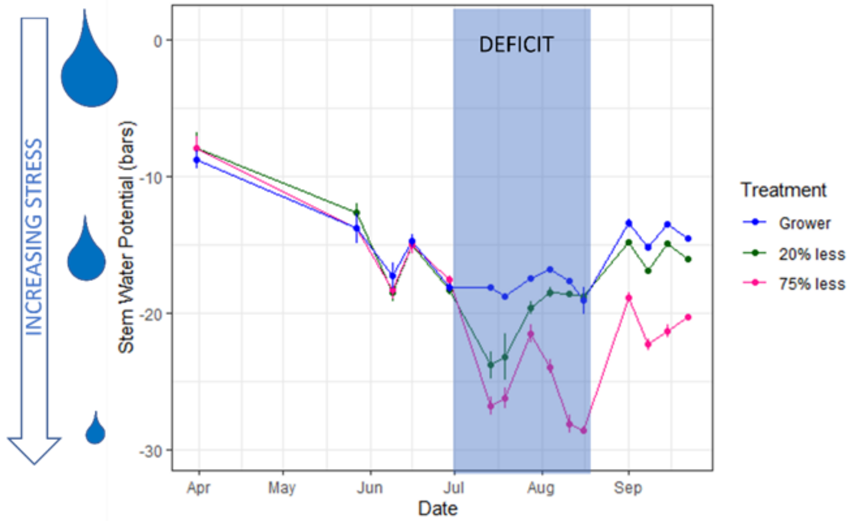

Figure 3. Example of the impact of deficit irrigation during pit hardening (July to mid-August) on tree water status (expressed as stem water potential, bars) with respect to the control treatment (grower practices, no reduction in water application).

The deficit irrigation reduced tree water status (Fig. 3). The tree water potential decreased (more negative, more stress!) in both treatments but trees recovered within a few weeks after full irrigation was restored. The recovery was slower when water was reduced by 75 percent.

Deficit irrigation neither affected fruit yield nor oil production, but it slightly decreased shoot vegetative growth in September, which could be beneficial to control undesired canopy growth. More years of data are needed to characterize the impact of the treatments on orchard productivity.

Acknowledgments:
We wish to thank all the collaborating researchers involved in this project. We would like to acknowledge grower Richard Marchini and the California Olive Ranch (COR) for their co-operation on these trials, and the Olive Oil Commission of California for financial support.

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Kosana Suvočarev, Dept. of Land, Air, and Water Resources, UC Davis
Emily Santos, Dept. of Plant Sciences, UC Davis
Giulia Marino, Dept. of Plant Sciences, UC Davis

UC ANR Announcements and Calendar of Events

Rice Experiment Station Annual Field Day
Wednesday, August 31, 2022
7:30am-12pm (lunch included)
Rice Experiment Station, 955 Butte City Hwy., Biggs, CA 95917
For more information, visit https://crrf.org/event/california-rice-experiment-station-field-day/.

UC Dry Bean Field Day
Thursday, September 1, 2022
9:00am – 11:00am
Directions from Hwy 113 in Davis: Take Hutchison Drive west, and at the roundabout, go straight. Then, turn left on Campbell Road. Drive approximately 0.2 miles, and then turn right into the Campbell Tract research facility.
Contact: Michelle Leinfelder-Miles, 209-953-6100

UC Alfalfa and Forage Field Day
Thursday, September 29, 2022
7:30am-12:30pm (lunch included)
Kearney Agricultural Research and Extension Center, 9240 S. Riverbend Ave., Parlier, CA 93648
Contact: Michelle Leinfelder-Miles, 209-953-6100

World Alfalfa Congress
November 14-17, 2022
San Diego, CA
For more information and to register, please visit: https://worldalfalfacongress.ucdavis.edu/. Early bird registration ends September 30th.

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CE

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