Field Notes
San Joaquin County
November 2019

University of California
Agriculture and Natural Resources

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Vegetable Crops Disease Update: Bacterial Bulb Rots of Onion

A group of three UC farm advisors and a UCR Plant Pathologist have received a grant from USDA (NIFA Award #2019-51181-30013) to research onion bacterial bulb diseases in collaboration with a larger group of researchers from 11 other states. This upcoming onion season, we'll be starting surveys of commercial onion fields. Beginning the following season, we'll establish field trials to evaluate management methods. I will be looking for affected onion fields in spring/early summer of 2020. I hope you'll call or email me to let me know about any local fields with suspected symptoms.

Symptoms of bacterial diseases in the bulb may include:

- Discoloration, softening and water-soaking of the bulb tissues
- With some of these diseases, individual scales (e.g "rings") within the bulb are discolored or rotten, while the adjacent scales remain healthy (see Figure 1 inset). In this case, affected scales can often be traced back to a leaf that also had symptoms.
- Neck may be soft when pressed

Symptoms on the leaves may include:

- Yellow flagging on one or more leaves (see Figure 1)
- Watersoaked areas on leaves

Figure 1. Symptoms of Center Rot on leaves and bulbs (inset).From: Agarwal, G., Stumpf, S., Kvitko, B., and Dutta, B. 2019. Center Rot of Onion.The Plant Health Instructor. DOI: DOI:10.1094/PHI-I-2019-0603-01

More information on onion bacterial diseases:

UC IPM Guidelines:
https://www2.ipm.ucanr.edu/agriculture/onion-and-garlic/Bacterial-Soft-Rot/

APS page on Center Rot:
https://www.apsnet.org/edcenter/disimpactmngmnt/topc/Pages/CenterRotOnion.aspx

Bacterial diseases of onion bulbs cause more than $60 million a year in losses to the U.S. onion industry. Although a large portion of these losses occur during storage of dry bulbs, these pathogens also cause problems in the field and can affect the intermediate-day onions in our region. It can also affect onion seed fields, as the scapes may not develop successfully or may weaken and collapse. There are a number of different pathogenic bacteria that can cause bacterial bulb diseases. These bacterial pathogens have in common that they produce pectolytic enzymes that break down cell walls. This cell wall breakdown results in the characteristic symptoms of watersoaking and "soft rot" of the bulb tissues. Common names for these diseases include soft rot, center rot, slippery skin, and sour skin.

These bacterial diseases can be hard to manage. One of the primary challenges to control is the fact that the bacteria will reproduce and colonize the onion leaves without causing any symptoms. Once they reach a critical number on the leaf surface, then they are able to infect the onions. By that time, chemical control or other strategies are too late.

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In other words, chemical control needs to be preventative, before symptoms appear, to suppress the colonization of the leaves by bacteria. Cultural control strategies are also focused on avoiding the conditions that permit the bacteria to build up and move down into the bulbs. Since problems seem to be fairly sporadic in our region, it may not make economic sense to spray onions preventatively. Although copper is registered and can help suppress leaf colonization when applied early, it is not highly effective. For these reasons, cultural management strategies are recommended.

- Drip or furrow irrigation are advised. If using sprinklers, decrease the frequency and amount of irrigation once the onions start to bulb (when the bulb reaches twice the diameter of the neck). Sprinkler irrigation promotes spread of the bacteria and can wash them from the leaves down into the neck and bulbs.
- Avoid excessive nitrogen fertilization and avoid late applications of nitrogen. For fertilization guidelines for onions, see https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Onion.html.
- Varieties with tight necks are less susceptible to some of these diseases. For some of the diseases, thrips have been shown to play a role in the disease cycle by aggregating in the neck and spreading the bacteria with their feeding.
- Harvest only after onion tops are well matured (i.e. more than 90% of tops have lodged)
- Promote rapid and effective field curing and minimize wounding during harvest and packing.

In the US, several large-scale onion packers have installed bulb sorting lines that can detect internal defects and decays using cameras, so they can remove those bulbs prior to storage or shipping. However, this equipment is expensive and not feasible for smaller packing sheds.

In addition to evaluating management practices, our partners in this large, multi-state project will develop molecular diagnostic tools, as well as screening methods that will help breeders develop disease-resistant varieties. There are currently no varieties resistant to these diseases. Again, please assist our efforts by alerting me to local fields that might have the symptoms described here, even if you are unsure what the symptoms might be. Thanks for your help!

Brenna Aegerter, Vegetable Crops Advisor

Field Corn Variety Trial Results

The results of the 2019 UCCE Delta field corn variety trial, located on Tyler Island, are presented in Table 1. Three replicate blocks of fourteen varieties were planted on May 7th by air planter. The fourteen varieties included 11 varieties submitted by seed companies and three submitted by the grower. All varieties were glyphosate tolerant. Each plot consisted of four 30-inch beds on an average row length of 1300 feet. Seed was planted approximately two inches deep and six inches apart down the row.

The soil is a Rindge mucky silt loam with approximately 20 percent organic matter in the top 15 inches of soil. The Rindge series is a mucky peat soil down to about 60 inches, and approximately 55,600 acres in the Delta are described by the Rindge classification. The previous crop in the field was corn. Subsurface irrigation by "spud ditch" was employed twice. Anhydrous ammonia was applied pre-plant (115 units N/acre), and 8-24-6 with ½ percent of zinc was knifed in at planting (additional 33 units N/acre). Weed control was by cultivation and glyphosate herbicide program, and Onager miticide was applied. The field was harvested on October 21st.

Stand counts were made approximately two weeks after planting. The stand was assessed in the center two rows of each four-row plot, counting the plants along a 10-foot length. Bloom was assessed over the week of July 15th. We monitored disease incidence and plant lodging in late September. Disease incidence, particularly Fusarium ear rot, was lower in 2019 compared to 2018. A sign of Fusarium ear rot is white fungal mycelium around the kernels. The disease is usually introduced to the ears by corn earworm or by thrips that travel down the corn silks at pollination. Incidence may be reduced in varieties with longer or tighter husks that prevent insect infestations. Planting earlier in the season may also reduce incidence, as the crop may reach pollination before insect pests are prevalent. Head smut, a disease that replaces ears with dark brown spores, had low incidence this year. These two diseases are generally managed by variety selection.

The table presents mean values for the three replicates. The statistical method used to compare the means is called the Tukey's range test. Varieties were considered statistically different if their P value was less than 0.05, or 5 percent. What this means is that when differences between varieties exist, we are 95% certain that the two varieties are actually different; the results are not due to random chance. Differences between varieties are indicated by different letters following the mean. For example, a variety that has only the letter "a" after the mean yield value is different from a variety that is followed by only the letter "b", but it is *not* different from a variety whose mean value is followed by both letters ("ab"). Similarly, a variety whose mean yield is followed by the letters "ab" is not different from a variety whose mean yield is followed by the letters "bc". Eight varieties have a letter "a" following their mean yield, which means that those eight varieties all performed similarly in the trial. In other words, based on this research, we cannot attribute numerical differences to varietal differences.

In addition to yield, there were also statistical differences among varieties in days to bloom, Fusarium ear rot, head smut, ear height, grain moisture, and bushel weight. The CV, or coefficient of variation, is the standard deviation divided by the mean, or a measure of variability in relation to the mean. For the diseases, the variability among the three replicates was very high.

Special thanks go to the cooperating growers, Gary and Steve Mello, and the participating seed companies.

Michelle Leinfelder-Miles, Delta Farm Advisor

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Table 1. 2019 UCCE Delta field corn variety trial
By: Michelle Leinfelder-Miles, UCCE farm advisor

Entry Name	Company Name	Stand Count (Plants/A)	Days to Bloom	Fusarium Ear Rot* (%)	Head Smut* (%)	Common Smut (%)	Plants Lodged (%)	Ear Height (in)	Moisture (%)	Bushel Wt.* (lbs/bu)	Yield‡ (lbs/acre)
LG 7514VT2PRO	Grower entry	34267	70 d	5 b	0 c	0	0	53 cdef	14.9 bcd	61.3 abc	14623 a
SX 5543	Baglietto Seeds	35719	70 d	5 b	0 c	0	0	48 ef	14.7 bcd	62.0 a	14209 ab
INT 6588VT2PRIB	Integra	35719	74 a	3 b	0 c	0	0	59 abc	15.1 bcd	61.2 abc	13643 abc
REV 2658AM	Mycogen	33977	73 abc	1 b	1 bc	0	0	55 bcde	14.9 bcd	61.6 ab	13589 abcd
CP 5814SS	Croplan	33686	73 ab	1 b	2 abc	0	0	57 abcd	16.5 a	62.3 a	13272 abcde
A 644-32TRCRIB	Agrigold	34267	72 bcd	2 b	2 abc	0	0	60 ab	14.6 cde	60.9 abc	13095 abcde
INT 6533VT2PRO	Grower entry	36010	73 abc	3 b	5 ab	0	0	54 bcdef	14.3 de	59.8 bc	12951 abcde
CP 5678SS/RIB	Croplan	36881	73 ab	2 b	1 abc	0	0	48 f	15.2 bcd	61.3 abc	12904 abcde
LG 66C11VT2PRO	LG Seeds	34558	68 e	2 b	1 bc	1	0	54 bcdef	15.5 abc	59.4 c	12630 bcdef
P 1751AM	Grower entry	34558	73 ab	5 b	0 c	0	0	62 a	15.7 ab	61.5 abc	12490 bcdef
A 646-12VT2PRO	Agrigold	37171	70 d	2 b	13 a	1	0	54 bcdef	15.0 bcd	60.3 abc	11883 cdef
REV 2499AM	Mycogen	32525	72 abc	4 b	0 c	0	0	57 abcd	15.1 bcd	62.0 a	11785 def
INT 6284VT2PRIB	Integra	34558	71 cd	4 b	1 bc	0	0	52 def	13.6 e	60.3 abc	11625 ef
LG 60C33VT2PRO	LG Seeds	33396	70 d	22 a	2 abc	0	0	53 bcdef	12.4 f	59.7 bc	11078 f
Average		**34807**	**72**	**4**	**2**	**0**	**0**	**55**	**15**	**61.0**	**12841**
Coefficient of Variation (%)		**3**	**0.5**	**27**	**61**	**-**	**-**	**3**	**1**	**0.7**	**5**
Significant variety effect (P value)		**0.1503**	**<0.0001**	**<0.0001**	**<0.0001**	**N/A**	**N/A**	**<0.0001**	**<0.0001**	**0.0003**	**<0.0001**

Results for each variety are expressed as the average across three replications.
* Data were transformed for analysis. Arithmetic means are presented.
‡ Yield adjusted to 15% moisture.

Fungal Canker Diseases Affect Productivity of Sweet Cherry Orchards

Canker diseases caused by plant-pathogenic fungi are some of the main factors limiting productivity and longevity of sweet cherry trees in California. These diseases affect the wood, killing branches, scaffolds and trunks of cherry trees, causing extensive damage and significantly reducing annual yields. Canker diseases are commonly found in mature cherry orchards throughout San Joaquin County, where inoculum of these various diseases is present. Main fungal canker diseases include Eutypa dieback, Calosphaeria canker and Cytospora canker, and these must be distinguished from Bacterial canker caused by the bacterium pathogen *Pseudomonas syringae*.

What is a canker?

A canker in woody plants normally refers to a localized dead area in the bark and cambium of stems, branches or twigs caused by fungi, bacteria, or abiotic agents. Most plant pathogens are unable to penetrate bark directly but will quickly colonize wounded tissue. Most canker diseases are caused by fungi, which grow within the tree's bark and vascular tissues, killing the wood and bark of trees. In sweet cherry, most cankers are wood cankers, often initiating from the pith and heartwood, and then spreading into the sapwood.

What are the main fungal canker diseases of sweet cherry in California, and what are their symptoms?

Cytospora branch canker/dieback: also known as Leucostoma canker. The fungus attacks the woody parts of the trees through bark injuries and pruning cuts. Symptoms of Cytospora branch canker/dieback (Fig. 1A) include longitudinal cankers in branches and scaffolds associated with the exudation of gum at the point of infection. Cytospora fungi have traditionally been thought to be of relatively minor importance on sweet cherry; however, their prevalence in cankers suggests that this group constitutes virulent pathogens. Overall, this group of pathogens has become of increasing concern in recent years in many fruit and nut crops.

Calosphaeria canker: caused by the fungus *Calosphaeria pulchella.* Cankers are generally initiated around the pith and progressively invade the xylem, cambium, phloem, and cortical tissues (Fig. 1B). External symptoms of Calosphaeria canker are habitually less visible during the early stages of infection, particularly in large diameter scaffold branches. In the late stages of infection, cankers are noticeable and are usually associated with symptoms of branch dieback and leaf desiccation. Perithecia (fruiting bodies) of *C. pulchella* are produced beneath the periderm of infected scaffold branches and trunks (Fig. 1C). These are also important signs of the disease, easily detectable, and they can allow for field diagnosis of Calosphaeria canker.

Eutypa dieback: caused by the fungus *Eutypa lata* is also a common disease of apricot and grapevine. Infection generally occurs during rainy weather happening at the time of pruning. Symptoms in sweet cherry include wood cankers, wilting and death of branches. Limb dieback may occur several months or years after infection (Fig. 1D). Cankers mostly originate from pruning wounds on limbs or trunks, and the bark becomes dark with amber-colored gumming. *Eutypa lata* spreads to new pruning wounds by wind-driven ascospores released during fall and winter rains.

Management guidelines:

Canker diseases are best managed using a preventive as well as avoidance approach. Most importantly, pruning should be performed to avoid rain and when dry weather is predicted for at least two weeks. Pruning wounds serve as the main entry point for canker pathogens, and these must be protected following pruning of trees during the wet winter months. Sprinkler irrigation that wets the tree trunks may act just like rain and should be avoided. Water from rain and sprinkler irrigation combined with wind are important factors for aerial dissemination of canker diseases. Dr. Trouillas' laboratory recently evaluated the efficacy of different compounds to protect pruning wounds from infection by canker pathogens. Of the different fungicidal compounds tested, Topsin M and Quilt Xcel performed best against canker pathogens of sweet cherry allowing significant disease reduction. Fungicide products should be applied immediately after pruning to avoid the contamination of pruning wounds. When orchards are seriously infected with canker diseases and branch dieback occurs, remove diseased branches/limbs at least 4 to 6 inches below any sign of wood discoloration. The pruning cut should be made into healthy wood to ensure that all the disease has been removed. Incomplete canker removal wastes time and money with little to no benefit in disease management. Dead branches left in the orchard or adjacent to living trees provide inoculum for further infection and should be removed and destroyed. It is also advised to regularly disinfect pruning shears, particularly after cutting through dead wood, using common sanitizers or a flaming torch.

Mohamed T. Nouri, Orchard Systems Farm Advisor
Florent P. Trouillas, Plant Pathologist,
UC Kearney Research and Extension Center

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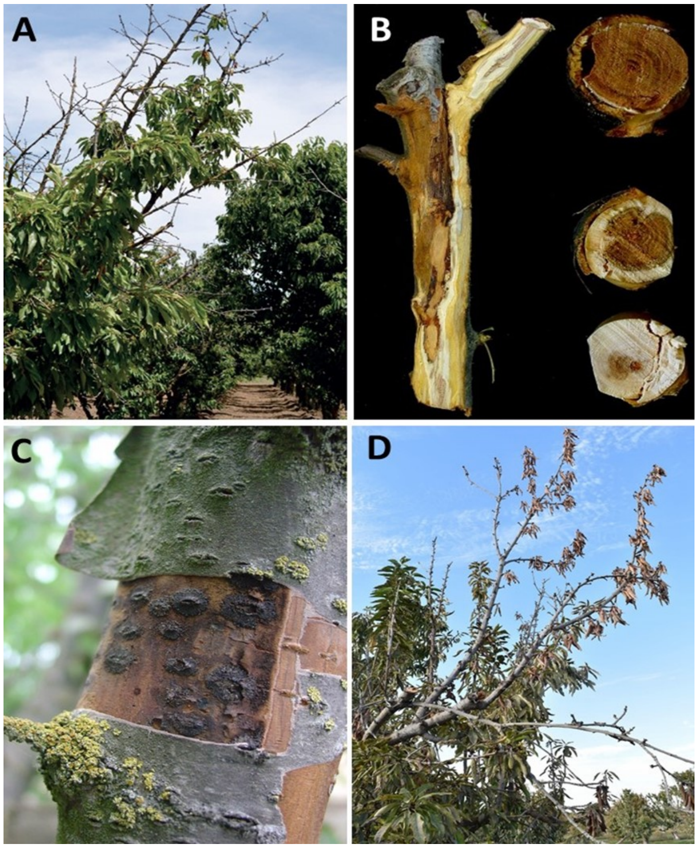

Fig. 1. Symptoms of canker diseases in sweet cherry, **A.** Cytospora branch canker/dieback, **B.** Calosphaeria branch canker, **C.** Circinate groups of *C. pulchella* perithecia beneath the periderm, **D.** Eutypa branch canker/dieback.

Rice Armyworm Monitoring

Earlier this year, I wrote about the armyworm monitoring that UCCE has been doing in Sacramento Valley and Delta rice fields. My colleague in Butte County, Luis Espino, has been leading this effort since 2015, and I have been monitoring in the Delta since 2016. The purpose of the project is to provide growers and managers with real-time information on armyworm pest pressure. (See Luis' armyworm alert email subscription: http://rice.ucanr.edu/armyworm_traps/.) Our efforts have also helped to inform the application for a Section 18 Emergency Exemption registration for Intrepid 2F (methoxyfenozide), which was approved in 2019, as well as in previous years. We monitored populations of true armyworm and western yellowstriped armyworm in three Delta locations. Moth flights are shown for the 2019 season in Figure 1. We reached the highest trap counts during the week of June 20th, averaging 43 moths per day across the three locations. This was earlier than the peak counts observed in the Sacramento Valley, which were during the week of July 1st. There, daily counts ranged from 20 to 60 moths per day, depending on location.

Trap counts markedly dropped in July, and while there was another slight increase in early-August, the populations never reached what they had in mid- to late-June.

UC IPM has guidelines for monitoring and treatment of armyworms(http://ipm.ucanr.edu/PMG/r682300411.html). While treatment thresholds are described as percent damage to the rice, moth counts provide growers and managers with information to guide their field scouting. Armyworm larvae (Figure 2) can be difficult to find in the field, especially when they are small and because they recede into the foliage at the water level when the daytime temperature warms. Thus, moth catches are an indication of worm pressure. In June, vegetative damage from worm feeding (Figure 3) can impact rice growth and development, and at two of the three locations, the grower treated in response to the June peak. Because armyworm larvae will grow to full size and pupate in about 3 to 4 weeks, we have wondered whether the late-June peak will result in a second generation later in the season. A second generation could potentially damage maturing panicles, causing them to dry out before maturing (Figure 4). We observed a small increase in moths at our monitoring sites in early-August, but we did not observe panicle damage.

I will hold my annual grower meeting on Friday, January 10, 2020 at 8:00 am at the Cabral Ag Center in Stockton. At that meeting, I will provide a "Delta Rice Update" where I will present more information on the annual armyworm monitoring, data from a herbicide trial I conducted this season, and a weedy rice update. Please mark your calendars, and I will see you in the new year!

Michelle Leinfelder-Miles, Delta Farm Advisor

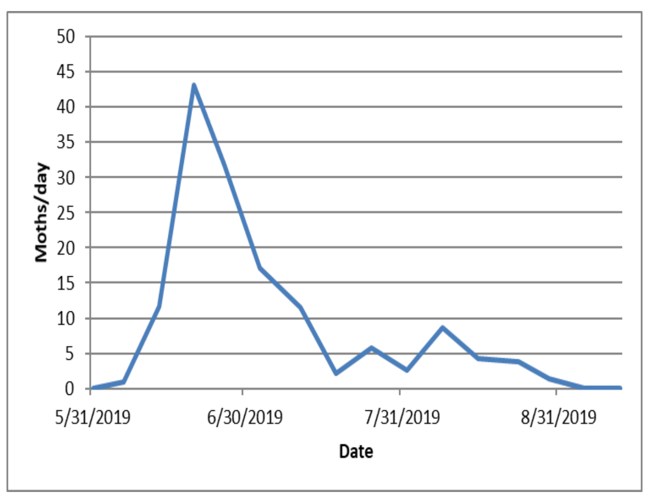

Figure 1. 2019 moth catches per day (true armyworm plus western yellowstriped), averaged across three Delta locations.

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Figure 2. True armyworm larva. While we trap for both true armyworms and western yellowstriped armyworms, the majority of what we catch are true armyworms. Photo courtesy of UC IPM.

Figure 3. Armyworm feeding on rice leaf. Photo courtesy of UC IPM.

Figure 4. Rice panicle damaged from armyworm feeding. Photo courtesy of UC IPM.

Calendar of Events

Alfalfa and Forage Symposium
November 19-21, 2019
Grand Sierra Resort, Reno, Nevada
For more information and to register, visit http://calhay.org/symposium/.

SJC and Delta Field Crops Meeting
Friday, January 10, 2020
8:00am to 12:00pm
Cabral Agricultural Center, 2101 E. Earhart Ave., Stockton
Contact: Michelle Leinfelder-Miles, mmleinfeldermiles@ucanr.edu

California Rangeland Conservation Coalition Summit
Tuesday, January 14, 2020
9:00am to 6:00pm
Cabral Agricultural Center, 2101 E. Earhart Ave., Stockton
Contact: Theresa Becchetti, tabecchetti@ucanr.edu

CA Cherry Research Review
Wednesday, January 22, 2020
9:00am to 1:00pm
Cabral Agricultural Center, 2101 E. Earhart Ave., Stockton
Contact: Mohamed Nouri, mnouri@ucanr.edu

Northern San Joaquin Valley Processing Tomato Production Meeting
Wednesday, January 29, 2020
8:00am to 11:00am
Modesto Centre Plaza/Doubletree Hotel, 1000 L Street, Modesto
Held in conjunction with the California Tomato Growers Association 73rd Annual Meeting
For information on the educational portion, contact Scott Stoddard at (209) 385-7403 or csstoddard@ucanr.edu.
For information on the CTGA luncheon meeting and exhibition: (916) 925-0225 or ctga@sbcglobal.net

North San Joaquin Valley Almond Day
Friday, January 31, 2020
8:00am to 12:00pm
Modesto Centre Plaza/Doubletree Hotel, 1000 L Street, Modesto
Contact: Brent Holtz, baholtz@ucanr.edu

UCCE

University of California
Agriculture and Natural Resources

Cooperative Extension
San Joaquin County

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

Notes from the Field

November 2019