



California Melon Research Board

2021-22 Research Interim Report List

Leader	Project Title	Total Approved 1/7/2021
Gilbertson/Turini Wintermantel	Monitoring for Insect Vectors in Melons, Development of Vector-Independent Screening Methods and Investigation of Late-Season Outbreaks of Aphid-Transmitted Viruses	21,500
Mauck	Optimizing Elicitor Combinations, Dosage, and Timing for Prolonged Virus Control in Melon	5,425
Palumbo	Insecticide Alternatives for Insect Management in Melons	14,058
Sidhu/Nunez	Evaluation of Rotation of Alternative Nematicides for the Control of Root-Knot Nematodes in Melons	9,500
Stoddard	Weed Control and Cost Benefit Analysis of Automated Cultivators to Control Within-Row Weeds in Melons	4,400
Sumner/Stewart	Costs and Returns to Produce Melons in Three Growing Regions in California	25,000
Swett	Addressing Diagnosis and Management Needs for Emerging, Poorly Understood Fusarium Solani-Type Pathogens of Muskmelons in California	16,708
Vinchesi/ Grettenberger	Improved Monitoring and Management Strategies for the Western Striped Cucumber Beetle in Melon Production	16,575
Wintermantel	Monitoring the Seasonality and Incidence of Whitefly-Transmitted Yellowing Viruses in Low Desert and Central Valley Melon Production Regions, and Determining of the Threat of CYSDV and CCYV to Central Valley Production	5,500
TOTALS		\$ 118,666

Interim Report to the California Melon Research Board

Project title: **Monitoring for insect vectors in melons, development of vector-independent screening methods and investigation of late-season outbreaks of aphid-transmitted viruses**

Principal investigator (PI): **Robert L. Gilbertson**, Distinguished Professor, Department of Plant Pathology, UC Davis

Co-PIs: **Tom Turini**, Farm Advisor, University of California Cooperative Extension, Farm Advisor, Fresno County; **William Wintermantel**, Virologist, USDA-ARS, Salinas; Cooperators: **Marcela Vasquez-Mayorga**, Graduate Research Assistant, Department of Plant Pathology, UC Davis.

1. Monitoring for aphid and whitefly populations in melon fields in the Central Valley in 2021.

On July 20, 2021, a survey for aphids and whiteflies and virus symptoms was conducted by Bob Gilbertson, Bill Wintermantel and Tom Turini in a late-planted experimental trial at Westside Field Station, three commercial melon (cantaloupe) fields, and one commercial watermelon field. The fields ranged from flowering to harvest stages and were located in the Five Points and Mendota area. We did not observe aphid and whitefly populations or virus symptoms in the surveyed melon fields, indicating that these were not affecting the early planted fields. However, the watermelon field had substantial populations of whitely adults (~5/plant), but no obvious virus symptoms. This appeared to be an outbreak of *Bemisia tabaci* whiteflies.

2. Continue development and optimize agroinoculation systems.

In this part of the project, we continue to develop full-length infectious clones of large plant-infecting RNA viruses that infect cucurbits, e.g., squash vein yellowing virus (SqVYV), cucurbit yellow stunting disorder virus (CYSDV) and cucurbit aphid borne yellows virus (CABYV). Our efforts continue to be stymied by instability of these large constructs in the intermediate *Escherichia coli* strains typically used in the cloning process. Therefore, we have decided to take a new novel approach to solve this problem: **synthetic biology**. The strategy involves using synthetic biology to generate an accurate and stable construct (recombinant plasmid) that can be directly transformed into *Agrobacterium tumefaciens* cells. The resulting transformants can then be directly infiltrated into cucurbit leaves where, hopefully, the successful inoculation/infection will happen, followed by systemic infection. Thus, it is hoped that the application of synthetic biology will bypass the instability of the constructs.

The 5' end of the genome plays an essential role in the infectivity, therefore a RACE (rapid amplification of cDNA ends) analysis was performed to confirm the 5' end sequence of the genomic RNA of SqVYV before sending the sequence for synthesis. Sequencing results from the RACE analysis were aligned and a consensus sequence was obtained. This consensus sequence was incorporated into a final genomic sequence, which was sent to Gene Universal for synthesis. The sequence sent for synthesis includes two restriction sites in the 5' and 3' end of the construct to facilitate cloning into an *Agrobacterium* binary vector. To do this, we provided the binary

vector, pJL89, to Gene Universal and they are currently generating the construct. Gene Universal guarantees the sequence of the SqVYV are correct. As soon as the construct is received, we will transform it into *A. tumefaciens* and inoculate cucurbit plants.

3. Investigation of the association of outbreaks of an aphid-transmitted virus complex in the Central Valley with irregular fruit ripening.

In trying to better understand the factor(s) associated with this late season fruit abnormality where there can be a corky inner ring and associated discoloration, we have consistently detected a mixed infection of two types of aphid-transmitted viruses: mosaic- and yellows-type. The mosaic viruses are cucumber mosaic virus (CMV), watermelon mosaic virus (WMV) and zucchini yellow mosaic virus (ZYMV), and the yellows virus is CABYV. As indicated above, we did not observe mosaic or yellowing symptoms or aphid infestation in melons in the early season survey in Fresno (20 July), including a field in the area known to have this problem. There also were no reports of fruit abnormalities. We received two melon samples with symptoms of severe mosaic and distortion from commercial melon fields in Fresno in mid-August, and we used the combination available diagnostic tools to show that both samples were singly infected with WMV, which is one of the prevalent mosaic-type viruses. Now that the first of these viruses has been detected, we will focus on the development of virus symptoms in the late-planted melon field. Finally, we are obtaining, characterizing and selecting the mosaic and yellows viruses for mixed infection studies.

CALIFORNIA MELON RESEARCH BOARD

Progress report September 1, 2021

Project: Optimizing elicitor combinations, dosage, and timing for prolonged virus control in melon.

Principal Investigator:

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Summary: The long-range goal is to develop integrated management solutions for whitefly and aphid transmitted virus control in melons in California. We expect such strategies to involve a combination of approaches that boost host plant resistance to virus infection, replication, and systemic spread while limiting expression of symptoms that encourage transmission by insect vectors. These strategies will synergize with area-wide efforts to manage virus and vector reservoirs and reduce the impacts of other pests on melons (e.g., via crop rotations), as well as ongoing efforts to breed whitefly and virus resistance into western U.S. shipping-type cantaloupe and honeydew cultivars. Knowledge of plant priming agents and their utility as components of disease management programs is essential to achieving sustainable, reliable management in CA melon production areas with diverse pathosystems.

Our prior CMRB-funded work indicates that acibenzolar-S-methyl (ASM, trade name Actigard) is a viable tool for virus control, but we do not yet know how to prolong the protective effects beyond a 3-week window after the first application. Plants are not immune to infection following ASM treatment but exhibit significantly enhanced tolerance and capacity to suppress systemic virus movement and replication. While this boost to plant growth under infection is promising, even greater benefits may be realized if elicitors can be used continuously for infection suppression with little to no negative effects on plant growth. This may require a complementary approach that includes products with different modes of action applied at specific times in plant growth progression. To identify options for prolonged virus suppression, we pursued the following objectives for the current project:

1. Evaluate effects of multiple doses of ASM on tolerance to infection by CMV and CYSDV.
2. Evaluate the effects of additional elicitor products on plant growth and tolerance to infection by CMV and CYSDV.

3. Evaluate virus suppressive effects of select combinations of elicitor products based on results of objectives 1-2 above.

Methods

We performed experiments in the greenhouse following methods used previously for evaluating ASM for virus control (Kenney et al. 2020). To evaluate multiple doses of ASM, we pretreated cv. "Gold Express" melon plants in the ~3 leaf stage with a foliar application of 25ppm Actigard product, or a water control. Four days later, we inoculated plants in each ASM category with CYSDV or CMV (each virus as separate experiments) using viruliferous whiteflies (CYSDV) or mechanical inoculations (CMV). Two weeks following virus inoculation, half of the plants in each initial treatment category received a second dose of ASM applied as a foliar treatment (overall dose regimes: water-water, water-ASM, ASM-water, ASM-ASM). We collected data on symptoms at a time point before the second dose (symptom examples shown in Fig. 1), and then following the second dose. We also sampled tissue to measure virus titer and harvested plants to measure impacts of dosing and virus on plant growth.



Figure 1. Virus symptoms exhibited by plants in greenhouse experiments. CMV (left) and CYSDV (right).

Results. Symptom severity results have been compiled for CMV and CYSDV experiments. Statistical analysis will be completed when experiment repetitions conclude (in progress). For CMV, ASM pre-treatment slightly attenuated symptom expression at 14 days. However, there did not appear to be a benefit from applying a second dose at the 14 days post-inoculation time point just after recording symptom severity (Fig. 2)

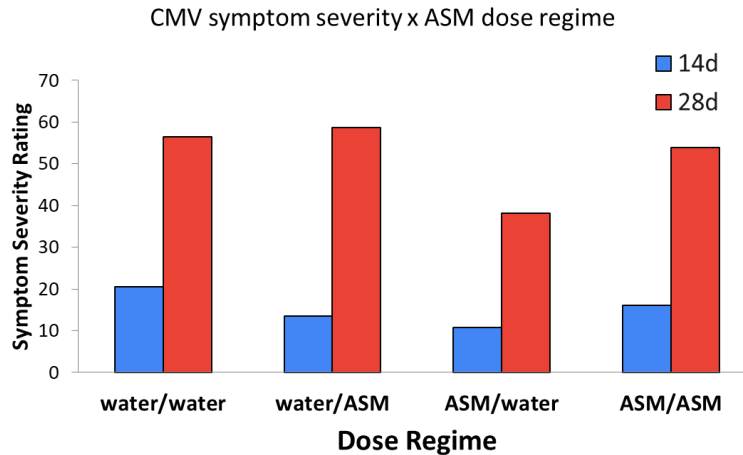


Figure 2. Summary of ASM effects on CMV symptom severity as determined by the rating scale published in Kenney et al. 2020. Bars represent the mean of 8 replicate plants per treatment. A second repetition is in progress.

For CYSDV, positive effects of ASM pre-treatment were more pronounced at the 14-day time point, with almost no symptoms apparent (Fig. 3). This is consistent with our prior work (Kenney et al. 2020). Again, application of a second dose of ASM at the 14-day time point had no effect on disease progression. Another important result of this experiment is the finding that application of ASM *after* inoculation/infection establishment has no effect on CYSDV symptom progression. This indicates that the utility of ASM for virus prevention is limited to pre-treatment effects. That is, the priming must take place before pathogen challenge.

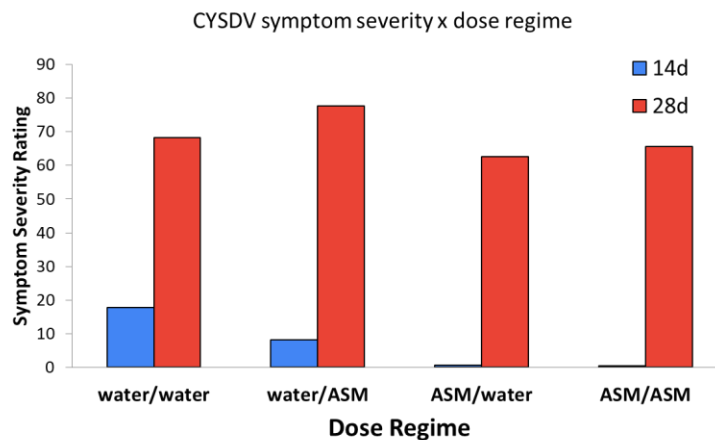


Figure 3. Summary of ASM effects on CMV symptom severity as determined by the rating scale published in Kenney et al. 2020. Bars represent the mean of 8 replicate plants per treatment. A second repetition is in progress.

Next steps/troubleshooting

Objective 2 will be completed after we verify results for Objective 1 (complete second repetition of the experiments, currently in progress). Methods will follow those for Objective 1, but instead of ASM dose regimes, we will test three additional elicitors with alternative mechanisms. Depending on results of Objective 2 (promising compounds identified), we will proceed with Objective 3 using 1-2 defined combinations. For challenges encountered thus far, we had issues with account set up by the university that delayed release of funds, now resolved. We

also had to amplify CMV inoculum from stored stocks because the first iteration of the CMV experiment had low inoculation success in controls. This is likely due to the long storage time of the inoculum without transmission in living hosts (all of 2020 during limited lab access). Successfully infected plants from this first experiment were retained to produce a new inoculum stock, and the experiment was set up again.

Insecticide Alternatives for Insect Management in Melons

John Palumbo, University of Arizona, Yuma AZ

Research identifying insecticide alternatives to neonicotinoids against *Bemisia* whiteflies and CYSDV in melons was the focus of our 2021 project, as well as an exciting new compound for seed corn maggots on spring melons. Research was continued this year to investigate use of foliar and soil insecticides on direct seeded cantaloupes. We were able to develop new information that will be helpful to desert growers.

In early spring, a trial was conducted to examine a new soil insecticide as an in-furrow spray for control of seed corn maggot (SCM) on cantaloupes. Maggot pressure was heavy with only 5% of untreated melons seed emerging. Results showed that, the in-furrow application of Cimegra provided control comparable to the standard Capture LFR (~85% emergence). We conducted a second SCM trial 3 weeks later with several new seed treatments, but maggot pressure was light and no differences among the treatments was observed.

Several efficacy trials were established in early May to evaluate new experimental and existing insecticide alternatives for management of whitefly adults/CYSDV in direct-seeded cantaloupes. Whitefly populations were light-moderate and CYSDV incidence was greater than we've seen in previous years. In one trial, an experimental soil, systemic insecticide (UAEXP11630) applied via drip chemigation did not control whitefly adults or nymphs comparable to the industry standards (Venom and Sivanto prime). In another trial, the new insecticide, spiropidion, was found to provide good control against whitefly nymphs comparable to PQZ and Sefina, but less active against adults. Further testing may show that it can be effectively incorporated into fall programs for adult and CYSDV suppression. Another trial comparing registered foliar spray alternatives showed that PQZ, Transform and Sefina provided significant whitefly control/CYSD suppression compared with Assail, Harvanta, and PureCrop1.

Fall trials are currently underway (planted Aug 17) and whitefly pressure is moderate-heavy. We are continuing our work with PQZ, Sefina Transform, and Assail to determine their best fit in early season adult whitefly / CYSDV management. We have also initiated a trial to evaluate the efficacy of spiropidion as a soil, shank treatment at planting compared to the standards (Venom and Sivanto). We are comparing these compounds as foliar sprays. CYSDV will be evaluated in these trials.

California Melon Research Board Mid-season report January 2021 to December 2021

Project Title: Evaluation of Alternative Nematicides for the Control of Root-Knot Nematodes in melons

Project Leader: Jaspreet Sidhu and Joe Nunez

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This study is being conducted as small plot field trials on our nematode nursery at the Shafter research farm, Shafter. A western Shipper type melon variety ‘Durango’ was hand transplanted onto 60- inch beds on June 30, 2021. There are four replications and seven treatments in this trial (Table 1). Each plot is 60 inches wide and 20 feet in length. Treatments were applied either as a pre-plant or post-plant application through buried drip as shown in table 1. The plots are maintained using standard agronomic practices. One application of insecticide Admire and fungicide Fontelis was made on July 6, 2021 through drip system.

Before applying the treatments, soil samples were collected (from each plot) and submitted to nematology lab at UC Davis (Amanda Hodson) to determine the RKN count. Soil samples will be collected and analyzed for nematodes again at harvest. Plant vigor and number of plants per plot was assessed at mid-season. Melon roots (5 plants) were evaluated for root galling at mid-season. Roots will be evaluated again at harvest for galling. Data on nematode counts and root galling will be analyzed using SAS (statistical analysis software).

Table 1. Treatments, rate, and application timings

Treatment	Trt code	Time of application	Rate/A	Rate/plot	Date applied
Untreated control	1				
Nimitz	2	At planting	5pt/A	5.4 ml/plot (21.6 ml)	06/30/21
Organic GroPro	3	At planting, 2 additional application after mid-season galling		20ml/ plot (80 ml)	06/30/21
FMC	4	At planting, 30,60,90 DAP	1L/ Ha	0.93 ml/plot (3.7 ml)	06/30, 07/28, 08/30, 09/29
DP Syngenta	5	At planting	9.12 fl oz/A	0.62ml/plot (2.48ml)	06/30/21
Velum	6	At planting	6.5 oz/ A	0.44 ml/plot (1.76 ml)	06/30/21
Velum	7	Post plant	6.5 oz/ A	0.44 ml/ plot (1.76)	07/07/21

CA Melon Research Board
2021 Research Progress Report

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Project: Weed control and cost benefit analysis of automated cultivators and herbicides to control within-row weeds in melons.

This trial began on July 16, 2021, in a commercial late-season field near Dos Palos, in Merced County. Melon variety Caribbean King was direct seeded on July 7 on 80” centers and 16” seed row spacing. No pre-emergent herbicides had been applied prior to the initiation of this project. Herbicide treatments were Prefar 6qts/A, Sandea 1 oz/A, Curbit at 4 pts/A, fmechanical cultivation using finger weeders, mechanical cultivation using automatic cultivator (Robovator), and an untreated control.

All herbicide treatments were applied after crop emergence but before weed emergence. The initial herbicide application was made on July 16 with an over-the-top application of Prefar when melons were 1 true leaf, then incorporated into the soil by hand; subsequent applications of Sandea and Curbit were made on July 29. Curbit was directed as a band application on either side of the plant row to minimize contact with foliage. Herbicides were applied with a CO₂ backpack sprayer at 38 psi with a 4-ft boom using two Tee Jet 8002 flat fan nozzles and two 8002 OC nozzles on the ends, calibrated to 26.8 gpa equivalent. Spray swath was 60” when measured ~24” above the soil surface. Cultivation treatments were also done July 29 (Figure 1). The finger weeder was run at 3.5 mph, while the Robovator worked at 1.8 mph.

Plot size for the herbicide treatments is 1 row by 40 ft; the cultivation treatments were 1 bed by the length of the field, about 800 feet. The experimental design was an RCB with 4 replications.

Due to the hard and cloddy nature of a Dos Palos soil, the finger weeder was used with the stiffer, medium length fingers. While weed emergence was minimal, this set up worked well and caused no visible crop injury. The Robovator also worked well at this location, even though plants were larger than ideal. However, the blades were running shallower than expected, and the machine was overheating halfway through the plots. Weed and crop injury evaluations were made on Aug 13 and Aug 20. No crop injury from any of the treatments was observed, and weed pressure has been minimal to date. Further evaluations are planned in September, as more weeds would be expected now that the field was furrow irrigated on Aug 18. Harvest is planned for early October.



Figure 1. Robovator (left) and finger weeder (right) on July 29, 2021, Dos Palos, CA.

Project title: Costs and Returns Studies on Melons in Three Growing Regions in California

Don Stewart and Dan Sumner, Department of Agricultural and Resource Economics, UC Davis

We contacted farm advisors in early 2021 to schedule costs studies in melons. All the advisors were interested in working on the studies, but indicated we would start the studies later in the year.

We have designed the three studies and are preparing economic data. We have scheduled the participation of the relevant UCCE county farm advisors that are stationed in key regions of California: Brenna Aegerter, Sacramento County, and northern San Joaquin Valley, Tom Turini, Fresno County, and southern San Joaquin Valley, and Michael Rethwisch and Etaferahu Takele, Riverside County and the desert region. We have planned studies for three different melon varieties, one will be watermelons and the other two not yet finalized.

We have made good progress on the preparing economic data for each of the three cost studies. During September we will get economic data into the needed format and set up our “Budget Plan. Farm advisors will make their needed contributions on two of the three studies in early October and later in October for the third study.

These studies are not simple updates from previous studies because much has changed. The new studies will contain new production management as well as up to date economic data. The advisors have been collecting information throughout the year on melon production in their regions. We have labor and irrigation information gathered from other recent studies that can be incorporated into the melon studies. We will complete the studies this fall.

CALIFORNIA MELON RESEARCH BOARD-Interim report

September 1, 2021, C. Swett

Project title: Addressing diagnosis and management needs for emerging, poorly understood *Fusarium solani*-type pathogens of muskmelons in California

STATUS, PITFALLS, REMIDIES & NEXT STEPS: BY OBJECTIVE

Objective 1. *F. solani*-type vine decline and rot pathogens: diagnosis and management

1.1. Statewide surveys to identify and characterize symptoms of *F. solani*-associated with plant decline, and root, stem and fruit rots. Status: Received 19 cucurbit crop samples, including many melons, starting at the end of May. Symptoms included seedling damp off, and wilting, stunting, root rot and lead spots of mature plants. Diseases diagnosed include charcoal rot, *Fusarium* root rot, root knot nematode, beet curly top virus, and *Fusarium* wilt. All samples photodocumented. Pitfalls and remedies: None. Next steps: Continue to provide diagnoses. **1.2. Conduct molecular analyses to identify *F. solani*-type species and assess species diversity.** Status: Sequence analysis has been conducted for 10 isolates, establishing that there are at least two different *F. solani*-type species associated with cucurbit rot and decline. Pitfalls and remedies: None Next steps: Continue to sequence ID *F. solani*-type fungi recovered from diseased melons in 2021. **1.3. Conduct pathogenicity trials for *F. solani*-type isolates and evaluate host range.** Status: We evaluated four methods for proof of pathogenicity. Root rot developed in all root inoculation treatments (~25% of root ball remaining) with controls root balls 75-90% healthy. The spore suspension drench method without foot wounding was the most consistent and severe. Pitfalls and remedies: Initial trial to evaluate inoculation methods took 20 weeks to see if canopy symptoms developed. We established that canopy symptoms will not develop and are going to shorten future trials to 9 weeks and focus on root rot symptoms. Next steps: We are initiating melon pathogenicity trials in September. **1.4. Use above to develop guidelines for field diagnosis and present information at meetings statewide, to raise awareness of affected regions.** Status: Every diagnostic sample is photologged for future use. Images are also captured of symptoms in controlled trials. In farm visits, we photograph in-field disease symptoms. These photos, coupled with the diagnoses, are being used to develop resources on field diagnosis. I have presented updates on this work at several ANR meetings for crop advisors. This information was also used in the updates to the ANR Cantaloupe production summary produced by Wang et al (in prep). Pitfalls and remedies: It would be helpful to get input from the melon board on methods of disseminating this information to growers and PCAs. Next steps: Publish via county-level ANR publications. **1.5. Provide decision support to muskmelon growers** Status: We have provided diagnosis services to melon growers across the state, which have aided in decision support. Pitfalls and remedies: None Next steps: Continue to provide

Objective 2. Evaluating commercial muskmelon cultivars for resistance traits against *F. falciforme*.

2.1. Evaluate six commonly grown commercial muskmelon cultivars for resistance traits. Status: The trial planted, May 20, was arranged in a randomized complete block design with three blocks, with dip inoculated, wound inoculated and non-inoculated treatments. Treatments were assigned to 15 foot plots planted at 1.5 foot spacing. Cultivars: Origami, Katza, Morgan, Infinite Gold, Karameza and Bounty. Yield and canopy data collection began on Aug 6 for Origami and for all other cultivars on August 17 (BRIX of 10.5-12), since fruit rot was noted. Yield data consisted of evaluating number and biomass of total fruit as well as the subset of fruit with damage (cracking, rot) for all fruit in the plot. We also evaluated BRIX for 5 random fruit per plot (noting damaged or marketable). Pitfalls and remedies: The fruit ripened and began to rot within 95 days of planting; in discussions with advisor Tom Turini we are not yet sure why the fruit broke down prior to 100 days. However, we were able to collect yield data and fruit were of marketable BRIX levels. Next steps: We will be collecting root and stem rot data in dip inoculated, wound inoculated and non-inoculated controls in early September, approximating the latest date that plants are left in the ground (~110 days). **2.2. Evaluate five Nunhems varieties for resistance traits.** Status: Inoculated plants were allocated to 15 foot strip plots, with five Nunhems cultivars. We evaluated yields and canopy decline as described on August 17. Pitfalls, remedies, next steps: As in 2.1

Objective 1 (2020): Evaluate organic and conventional insecticides and seed treatments for management of cucumber beetles in fresh-market melons.

This objective was carried over from our 2020 proposal, “Management of western spotted and striped cucumber beetle in melon production”. It was delayed due to COVID-19 restrictions.

We based treatments on what is commonly used commercially plus promising treatments that could have utility in either conventional or organic production. Treatments tested are shown in Table 1 along with the application method/parameters.. CidetrakL is a new formulation of a cucurbatacin-based gustatory stimulant product. We direct-seeded single lines of honeydews on 60-inch beds and at a high density at the UC Davis Plant Pathology farm. Seedlings were not damaged by cucumber beetles. Once cucumber beetles were observed in the field, treatments were applied on July 27 using a backpack CO₂ sprayer or as a soil drench (insecticide plus water) for Treatment 2 (Table 2). Plots were treated again on August 10 and August 24. Treatments 7 and 8 were applied weekly to provide sufficient coverage. Beetles were counted on plants in the center beds 3, 7 and 14 days after each application. Weeds were managed with a pre-emergent herbicide followed by hand weeding and fertilizer was injected through the drip. We will assess scarring damage in each plot in several weeks.

Trt #	Insecticide	Chemical name	MOA	Rate (per acre)	Adjuvant	Volume (GPA)	Nozzles/boom setup
1	Untreated check	--	--	--	--	--	--
2	Sivanto (Prime)	flupyradifurone	4D	28 oz, drench	--	?	NA
3	Bifenture EC + Assail 30SG	bifenthrin + acetamiprid	3A/4A	3 fl oz + 5.3 oz	NIS @ 0.25%	30	Small droplet
4	Bifenture EC + Assail 30SG + CidetrakL	bifenthrin + acetamiprid + gustatory stimulant	4A/28	3 fl oz + 5.3 oz + 12 fl oz	No drift @ 3.5 oz/ac	10	Large droplet/solids
5	Assail 30SG + CidetrakL	acetamiprid + gustatory stimulant	4A	5.3 oz + 12 fl oz	No drift @ 3.5 oz/ac	10	Large droplet/solids
6	Entrust SC + CidetrakL	spinosad + gustatory stimulant	5	8 fl oz + 12 fl oz	No drift @ 3.5 oz/ac	10	Large droplet/solids
7	Surround	kaolin clay, Organic (applied weekly)		25 lbs	None	50	Large droplet/solids
8	Surround + Celite	kaolin clay + diatomaceous earth, Organic - Surround applied weekly		25 lbs + 70 lbs	None	50	Large droplet/solids

Table 1. Treatments tested in the insecticide trial

Objective 1: Characterize use of non-crop habitat by the western striped cucumber beetle using a field cage trial and laboratory choice bioassays.

For these preference tests, we employed six mesh field cages (6×6×6 ft) intended to mimic early-season use of non-crop habitat of the western striped cucumber beetle (WStrCB) (Fig 1). Inside each cage, we had a completely randomized block design with four different plant species: milk thistle, wall barley, little mallow and wild radish. These plants were chosen based on 2020 non-crop habitat results. Each cage contained four clusters of weeds (in each corner) with a total of 16 plastic pots (4 pots per weed species). We released 30 WStrCB per cage and we recorded beetle feeding for each weed species inside each individual cage every 48-hours for 15 days. Unfortunately, we had issues early season getting plants established and obtaining sufficient striped cucumber beetles for the trials, and we had to troubleshoot a different approach. We shifted the experiment to a laboratory setting and are running a multiple-choice assay at a smaller scale. . We will have 10-15 replicates of large plastic containers with a mesh top (dimensions, 3.67 x 12 x 8.8 in) (Fig 2). Each container will have leaf discs from each weed species (3 cm-diameter), and

California Melon Research Board Progress Report 2021

Improved monitoring and management strategies for the western striped cucumber beetle in melon production

Vinchesi-Vahl and Grettenberger

we will place two beetles in each container and assess feeding every 24 hours. We sourced the weed species (milk thistle, little mallow, wild radish and wild mustard) from different areas within the Davis and the Woodland area. Consequently, each leaf disc will be assessed for feeding and we will quantify damage by measuring the damaged leaf area.



Fig 1. Field cages (6x6x6 ft.) with wild weed species for non-crop habitat preference field trial. Clockwise from top left: mesh cage aluminum frame, pots inside cage, adult WStrCB hanging out on a grass stem.

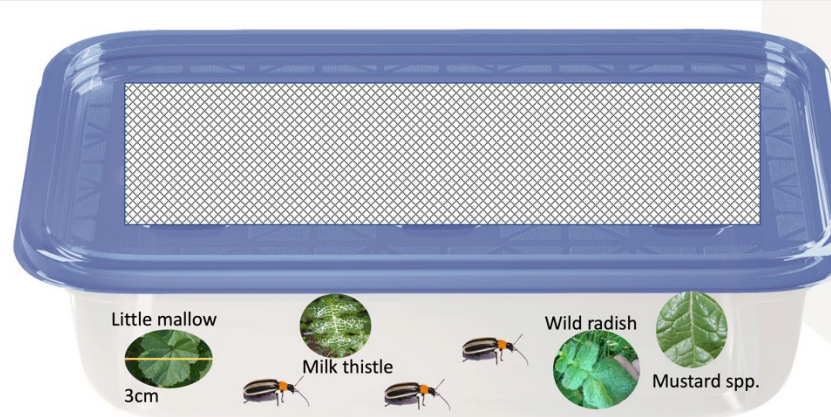


Fig 2. Plastic container for laboratory multiple-choice assay.

Objective 2: Evaluate attraction of the western striped cucumber beetle to the striped cucumber beetle aggregation pheromone and synergism with a floral lure.

We are currently testing the pheromone at two different locations. Treatments remained as proposed: 1) unbaited, 2) baited with the pheromone, 3) baited with a floral lure, 4) baited with pheromone and floral lure. We deployed four traps of each treatment throughout each field, arranged in spatial blocks, with blocks separated by 20m and 15m within traps. The first one is an organic squash field in Yolo County and the second one is a conventional melon field in Yuba County. We deployed clear sticky traps attached to 3 ft. wooden stakes in both field sites at different times in the growing season. The organic field was set up in late March 2021 and has been sampled weekly since early spring. We are currently counting beetles captured on traps for the early and mid-season collections. The conventional field was set up in mid-July, when melon seedlings had just started emerging. This field will be sampled weekly for 6 weeks. We are counting both WStrCB and western spotted cucumber beetles.

CALIFORNIA MELON RESEARCH BOARD

Interim Report 2021

Project Title: Monitoring the seasonality and incidence of whitefly-transmitted yellowing viruses in Low Desert and Central Valley melon production regions, and determining of the threat of CYSDV and CCYV to Central Valley production.

Principal investigator: William M. Wintermantel, Research Plant Pathologist, USDA-ARS, Salinas, CA; bill.wintermantel@ars.usda.gov

Cooperating personnel:

Robert L. Gilbertson, Professor, University of California-Davis

Tom Turini, Farm Advisor, UC Cooperative Extension, Fresno Co., CA

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Use traditional and real-time (quantitative) RT-PCR primers to evaluate melon plants for presence and (as appropriate) levels of each virus from melon field samples in both Low Desert and Central Valley production regions.

In the spring of 2021, melons and other cucurbits showing yellowing or other virus-like symptoms were collected from the Imperial Valley and the Yuma, AZ region. Samples were collected based on the presence of yellowing or other virus-like symptoms and sent to the Wintermantel Lab in Salinas for testing. Most sampling was conducted through the assistance of colleagues at UA Extension in Yuma (John Palumbo and Bindu Poudel), and UC Extension in Imperial (Apurba Barman). Plant extracts were tested by RT-PCR using the cucurbit virus multiplex primer system developed previously through this project to diagnose the presence of viruses. Results demonstrated that as in 2019 and 2020, cucurbit chlorotic yellows virus (CCYV) remained the predominant virus in the late spring season. Out of 95 melon, watermelon, and squash plants tested from the spring 2021 season (collected based on potential symptoms), 76 plants were infected with CCYV, 14 plants with CYSDV, 1 with SqVYV, and 7 with CABYV. Several had mixed infections. Additionally, because CYSDV and CCYV were identified in Fresno Co. in 2020, fields were visited from the same area in July 2021. Yellowing symptoms were not present yet, but whiteflies were present in some fields. Additional samples will be collected from both regions, Central Valley and Desert regions, during September and October to evaluate incidence in central California and determine if CYSDV remains the predominant virus during the fall desert season.

Monitor for the presence of these viruses among weed and alternate crops and to determine the California host range of newly introduced virus, CCYV.

To date, several weed samples have been collected from in and around melon fields in Imperial Co., California and southwestern Arizona. Of these, three species have been identified as hosts of CCYV and one of SqVYV. Additional sampling is planned for September/October.

Determine prevalence of CCYV, CYSDV and SqVYV in whitefly populations from the low desert production region to determine when whiteflies begin to carry substantial levels of these viruses.

All whiteflies collected to date through this project in both Central Valley and Imperial/Yuma are *B. tabaci* MEAM1. No additional biotypes have been identified.