California Melon Research Board

2014 Mid-Year Reports & CPS Projects Recap

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2	**New Insecticide Alternatives for Insect Management in Melons** John C. Palumbo, UA Yuma
3	**Evaluating the Efficacy of the Novel Nematicide "Nimitz" to Prevent Root-Knot Nematode Damage in Melon** Antoon Ploeg, UC Riverside
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These Projects are being funded by the Center for Produce Safety (CPS) Through Contributions from the Melon and Cantaloupe Boards	
5	**Practical Validation of Surface Pasteurization of Netted Melons** Trevor Suslow, UC Davis (*Jan 1, 2013 – Dec 31, 2014*)
6	**Enhancement of Forced-Air Cooling to Reduce Listeria Monocytogenes, Salmonella and/or Total Surface Microbiota on Cantaloupes** Changqing Wu, University of Delaware (*Jan 1, 2014 – Dec 31, 2014*)

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2014 MID-YEAR REPORT

Comparative Evaluation and Breeding of New Sources of Host Plant resistance to CYSDV and Sweet Potato Whitefly Biotype B, and Continued Efforts to Develop a Field-Based Serological Detection Method for CYSDV

Jim McCreight, Bill Wintermantel & Eric Natwick

Two field tests in 2014: a spring test mainly for evaluation of potential sources of resistance to sweet potato whitefly biotype B (SPWF-B), and a fall test with emphasis on host plant resistance to CYSDV.

Immediate Objective A. Characterize host plant resistance to CYSDV and introgress to western U.S. shipping type background adapted to the desert southwest U.S.

This test was sown and watered at DREC the week of August 18. The initial evaluation of plant stand and symptom onset is planned for the week of September 22 (5-weeks post-planting).

The fall test, which will be evaluated for symptom severity and virus titer, includes the following replicated tests.

- CYSDV-resistant selections, and their susceptible and resistant parents. This includes material from three published and five putative resistance sources.

- Genetic study of the inheritance of resistance of TGR-1551 to CYSDV.

Immediate Objective B. Test germplasm identified in 2012 as potential sources of resistance to SPWF-B. Repeat fall 2013 test under spring season growing conditions without insecticides.

This test was sown at the University of California, Desert Research and Education Center, Holtville (DREC) April 29 and 30 and watered on May 1. Whiteflies were present at time of planting and increased in numbers throughout the test period when the final evaluations were done during the week of July 28.

The test included 14 accessions identified as potential sources of resistance to SPWF in 2012, or in previously published reports. Periodic whitefly counts were initiated on 1 July. Whitefly data are in the process of being analyzed.

CYSDV incidence was 100%, and mean symptom severity ranged from 2.2 (TGR-1551) to 5.0 (F_1 Impac x TGR-1937) based on a visual scale from 1 (zero to 10% symptomatic foliage) to 10 (100% symptomatic foliage).

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2014 MID-YEAR REPORT

New Insecticide Alternatives for Insect Management in Melons

John Palumbo, University of Arizona, Yuma AZ

Research conducted in 2014 has been successful in generating new and useful information on insect management on fall and spring melons. The efficacy of several new insecticide alternatives was evaluated against whitefly adults/CYSDV and seed corn maggot in spring and fall melons. In early spring, a large trial was conducted to examine in-furrow spray applications for control of seed corn maggot (SCM) on cantaloupes. Maggot pressure was light and we did not observe any differences among treatments. Additionally, germination of our seed lot was poor (~50%).

In contrast, whitefly and CYSDV pressure was higher than normal in our spring trials. A number of whitefly trials were conducted to identify soil and foliar insecticide alternatives for suppression of adults and CYSDV. Melons were planted in late April to increase the chance of fall-like whitefly numbers and subsequent CYSDV infection. Whitefly adult numbers were initially moderate, but quickly reached high levels as harvest approached. CYSDV incidence was higher than we've previously seen in spring melons and we were able to determine differences in infection rates among treatments. Among the conventionally available products registered on melons, only Assail, Scorpion and Closer provided good adult control. Exirel (cyazypyr), a new product that should be registered soon, provided adult control that was comparable to the presently used standards. Among experimental products, Pyrifluquinazon remains the superior compound tfor both adult whitefly and CYSDV suppression. Among soil treatment, Sivanto (registration pending in AZ/CA) provided whitefly/CYSDV control comparable to Venom. Fall trials are currently underway to further evaluate soil, foliar and soil/foliar combinations on whitefly and CYSDV management. We are also investigating a new *Point Injection Application System* (aka, spoke wheel injection) to deliver soil insecticides most effectively at layby compared to conventional side dress applications. So far, whitefly populations have been relatively light, and CYSDV symptoms have not yet been observed after 3 weeks. The soil and foliar insecticide treatments however are providing control of whitefly adults and nymphs.

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2014 MID-YEAR REPORT

Evaluating the Efficacy of the Novel Nematicide "Nimitz" to Prevent Root-Knot Nematode Damage in Melon

Antoon Ploeg, UC Riverside.

A field trial was initiated on a root-knot nematode (*Meloidogyne incognita*) site at the SouthCoast Research and Extension Center, irvine, CA. The trial was designed according to a randomized block design with 5 replicates and 8 treatments. Nematicide treatments were compared to a standard Oxamyl, and a non-treated control. The treatments were:

1. Vydate 5 pt/acre at seeding and 15 days post
2. Nimitz-low, 3.5 pt/acre, 14 dbs[y] incorporated drench
3. Nimitz-high, 5.0 pt/acre, 14 dbs incorporated drench
4. Nimitz-low, 3.5 pt/acre, 14 dbs through buried drip
5. Nimitz-high, 5.0 pt/acre, 14 dbs through buried drip

Two additionan treattments of a novel unregistered Development Product (DP) were included:

6. DP low rate at seeding and 28 days post seeding
7. DP high rate 7 days pefore seeding and 28 days after seeding
8. Utreated Control (UTC)

Individual plots were 20 ft sections of 60-inch-wide beds. On 6/24/2014 Melon var. Durango was hand-seeded in the center of the plots. Twenty times three seeds were seeded at 1 ft intervals, and after emergence seedlings were thinned to 1 seedling per 1 foot. (An additional 5x3 seeds were seeded slightly off-center for mid-season gall indexing). At seeding, soil samples were collected to determine initial root-knot nematode populations. Plots were indexed for vigor once before final harvest. Melons were grown to maturity and were harvested on 9/19/2014. At this time all fruits were harvested per plot, and weighed individually. The number of plants were counted per plot, and five plants per plot were dug. Root systems of these plants were indexed for severity of root galling, and soil samples were collected from each plot to determine nematode population levels at harvest.

Data on nematode population levels, plot vigor, root-galling, and melon yields will be analyzed statistically using ANOVA procedures. The significance of differences between treatments will be determined at the 95% confidence level.

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2014 MID-YEAR REPORT

Melon and Weed Response to New Herbicides

Lynn Sosnoskie, UC Davis

Successful weed management is vital for the production of quality melons. Weeds compete with crops for light, space, nutrients, and water; competitive interactions, in turn, reduce yields. If left unchecked, weed interference can result in a decreased number of marketable melon fruits, decreased fruit quality, and reduced harvest efficiency. Weed control in melons is difficult due to the vining nature of the crop (which can prohibit mechanical cultivation) and the limited availability of safe and selective herbicides (particularly for the control of broadleaf species). The goal of the 2014 melon research program is to identify safe and effective herbicides for in-crop weed management.

S-metolachlor and sulfentrazone have been explored for PRE use in melons because of their superior weed control. In 2010 and 2011, sulfentrazone provided the best control of small-seeded broadleaf weed species in UC-Davis trials (T. Lanini: Personal observation 2010, 2011). Despite the occurrence of early season crop injury, cantaloupe yields were greatest in the sulfentrazone plots in both 2010 and 2011 (T. Lanini: Personal observation 2010, 2011). *S*-metolachlor caused temporary, early-season injury to melons in 2010 trials conducted at UC-Davis, but appeared relatively safe in 2011 (T. Lanini: Personal observation 2010, 2011). *S*-metolachlor has consistently provided good to excellent nutsedge control, and has proven to be an effective product for the management of annual grasses, pigweeds and lambsquarters (T. Lanini: Personal observation 2010, 2011). In both 2010 and 2011, melon yields from *S*-metolachlor treated plots were statistically similar to yields achieved in plots treated with sulfentrazone (T. Lanini: Personal observation 2010, 2011). In 2013, Zeus and Dual Magnum effectively controlled weeds and improved yields relative to the untreated control.

Trials (field and greenhouse) were established in 2014 to evaluate the performance of PRE Dual Magnum and Zeus in melons, both with and without the addition of herbicide safeners (two manufactured by Loveland Inc., one from Brandt Monterey). Early results suggest that resultant crop safety is significantly affected by interactions occurring between soil type, irrigation system and volume, and the herbicides. Another safener (Brandt Monterey) is being evaluated for use in POST applications of Sandea. Preliminary data indicate that the safener, when applied with Sandea, may protect melons from herbicide injury. Additional trials are being conducted to determine how pre-irrigation strategies can either reduce or enhance herbicide efficacy. A final study, and online survey, has been initiated to characterize melon grower practices and determine the most significant weed problems facing CA producers.

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SCOPE OF WORK
Jan 1, 2013 – Dec 31, 2014

Practical Validation of Surface Pasteurization of Netted Melons

Trevor Suslow, UC Davis

This Project is being funded by the Center for Produce Safety (CPS)
Through Contributions from the Melon and Cantaloupe Boards

Layperson's Summary

No one wants to take cantaloupes off the shelf or foodservice menu offerings. Since 1990, cantaloupes have been associated with 36 outbreaks and pathogen-based recalls recorded in the public health database. Preventive controls are viewed as the best strategy to combat this burden on consumers and public health, the general economy, and the sustainability of this important fruit category. This project will seek to translate well-established laboratory findings that support the effectiveness of hot water pasteurization of cantaloupe and other netted-rind melons into a validated and verified process. This research will be conducted in controlled experimental farm and model process studies and at newly constructed, essentially identical, rind pasteurization and disinfection lines in major commercial facilities in CA and AZ across two seasons. The outcome of these studies, using a combination of applied environmentally fit and adapted bacterial strains and native indicator bacteria, common to all melon production fields, will assist in the design and implementation of preventive controls and postharvest interventions for netted melons. This research data is viewed by many diverse stakeholders as vital to establish meaningful and verifiable food safety control measures to regain and enhance consumer confidence so badly shaken by the listerias tragedy of 2011.

Technical abstract

No one wants to take cantaloupes off the shelf or foodservice menu offerings. Since 1990, cantaloupes have been associated with 36 outbreaks and pathogen-based recalls recorded in the public health database. Preventive controls are viewed as the best strategy to combat this burden on consumers and public health, the general economy, and the sustainability of this important fruit category. The essential functionality of thermal surface-pasteurization of netted melons has been recognized at the basic and applied research level for over a decade, primarily as hot water immersion and hot water brush-washing. The reported inactivation of inoculated pathogens, predominantly *Salmonella enterica* serotypes, has exceeded a 4.5 log reduction. With the recurring economic losses and human tragedy associated with the most recent outbreak, we seek to assist in converting these bench-top studies to a validated and verified high-throughput commercial system across extended seasons, growing districts, varieties, netted rind traits, and other commercial variables. In

addition to meeting food safety goals, killing heat shocks may also positively or negatively impact the post-treatment keeping quality of cantaloupes and other more sensitive netted melons. Therefore, our proposed research plan will develop 'real-world' data for this postharvest disinfection treatment to arrive at a balance in which food safety objectives do not compromise the quality and arrive at a set of Best Practice options for the industry. To achieve this goal, experimental farm trials using an attenuated isolate of *Salmonella* Typhimurium and *Listeria innocua*, a surrogate for *Listeria monocytogenes*, will be conducted at the UC Davis Research Farm Facility. Fruit from these open environment trial will be subjected to hot water surface-pasteurization alone or in combination with a sequentially applied labeled disinfectant to achieve at least a 4-log reduction of applied pathogen surrogates and retain or improve fruit shelf-keeping properties. The recognized scarcity of detectable populations of pathogens, such as *Salmonella*, on cantaloupe in arid western production regions essential precludes verification of hot water pasteurization with non-inoculated fruit in either a lab pilot system or commercial system. Based on our experience from prior studies, we have targeted log reduction of indigenous Total Coliform as the appropriate benchmark for future commercial verification studies on-site that can be correlated with 4-log reductions of stress-adapted inoculated strains from model studies at Time:Temperature regimes that both define and parallel the commercial process design and operational parameters. Therefore, hot water surface-pasteurization alone or in combination with a sequentially applied labeled disinfectant in the twin commercial process systems will be verified to achieve a regional and temporally reproducible success criterion of at least a 2-log reduction of indigenous Total Coliform on netted melon rind and retain or improve fruit shelf-keeping properties. The outcomes of this research project will be very valuable for the cantaloupe industry and template SOPs should be extendable to other types of melons and durable fresh produce. We believe that a public information resource of this disinfection technology may be scalable, easily transferred, and successfully implemented by the global cantaloupe and netted melon supply and fresh processing industry.

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SCOPE OF WORK
Jan 1, 2014 – Dec 31, 2014

Enhancement of Forced-Air Cooling to Reduce Listeria Monocytogenes, Salmonella and/or Total Surface Microbiota on Cantaloupes

Changqing Wu, University of Delaware

This Project is being funded by the Center for Produce Safety (CPS)
Through Contributions from the Melon and Cantaloupe Boards

Layperson's Summary

During the cooling process, there is a unique opportunity of antimicrobial intervention to eliminate foodborne pathogens and/or spoilage organisms contaminating the surface of harvested cantaloupe. A cost-effective sanitizing process using a novel combination of ultrasonic atomization technology and antimicrobial formulation is proposed to integrate into commercial forced-air cooling systems. Different antimicrobial formulations and various operative conditions, including vaporizing rate, air-flow rate and treatment duration, will be investigated using our experimental systems to optimize the process and improve effectiveness against *Listeria monocytogenes* or *salmonellae*. Advantages of this process include: (1) Only minimal modification is required to current forced air-cooling methods by adding an ultrasonic device which is commercially available at low cost; and (2) Aerosolized antimicrobials absorb heat during evaporation and the new system can increase the cooling efficiency of an existing cooling system. To reduce operational cost, only Generally *Recognized* As Safe (GRAS) and commercial available antimicrobials with low cost will be tested. In addition, the impacts of this treatment on quality and shelf life of cantaloupes will be thoroughly investigated. A cost-effective intervention to reduce*L. monocytogenes* and *Salmonella* contamination would be quite valuable during the cooling process of harvested cantaloupes.

Technical Abstract

Cantaloupes have been associated with foodborne disease outbreaks in the US and are now considered to be a high risk commodity. During the forced air cooling of cantaloupes, there is an opportunity for antimicrobial intervention to reduce foodborne pathogens contaminating the surface of harvested cantaloupe. We propose to evaluate the efficacy of antimicrobial formulation using ultrasonic atomization technology in the forced-air cooling to reduce populations of *Listeria monocytogenes, Salmonella* and/or spoilage microbiota by at least 3 log/cm^2 on the surfaces of inoculated cantaloupes. The antimicrobial formulations will be developed based on chlorine, selected plant essentials, organic acids, hydrogen peroxide and foodgrade surfactants to take advantages of any synergism of

different antimicrobials to inactivate foodborne pathogens on the surface of cantaloupes. Different antimicrobial formulations and the various operative conditions, including temperature, concentration of sanitizer, air-flow rate and treatment duration, will also be investigated to optimize the process and achieve the desired cost-effectiveness with assistance from our industry collaborator. The antimicrobial formulations are vaporized by ultrasonication (to L. monocytogenes and *Salmonella* contamination would be quite valuable during the cooling process of harvested cantaloupes. **All microbial experiments will be conducted with the outbreak related pathogenic microorganisms of interest (not surrogates) in a biosafety level-3 facility.**

The advantages of this process include: (1) Only minimal modifications are required to existing forced air-cooling methods by addition of an ultrasonic device which is commercially available at low cost; and (2) Aerosolized antimicrobials absorb heat during evaporation, so the new system can increase the cooling efficiency of an existing cooling system. The overall objective of our proposed research is to develop a cost-effective sanitizing process which can be integrated into commercial forced-air cooling systems. The novel combination of ultrasonic atomization technology and effective antimicrobial formulations should reduce *L. monocytogenes,Salmonella* and/or spoilage organisms during the cooling of cantaloupes without affecting final quality and sensory attributes.