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VEGETABLE VIEWS

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2022 Research and Extension Projects

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The 2022 vegetable crop applied research and extension programs will include both continued and newly funded studies focusing on three interrelated themes: pest management of insects, weeds, and diseases; evaluating innovative production practices on vegetable crops; and optimization and protection of irrigation management and water quality.

I. Continued Research and Extension Projects

Pest management of insects, weeds, and diseases

Screening potential herbicide for use on basil. The basil herbicide screening project has come into its fourth year since 2019. In 2021, I tested a post-emergence herbicide (Tough 5EC with the active ingredient of Pyridate) on two commercial basil fields at Ratto Bros. in Modesto, CA. The results were presented in trade magazines and in previous issues of my newsletter. In 2022, the study will continue with the collaboration of Ratto Bros. and Western Region IR-4 using a different protocol. The change of protocol is based on basil injury, weed control effects, and yield performance from last year. Tough 5EC, a post-emergence herbicide for the selective contact control or suppression of actively growing annual broadleaf weeds, will be applied to basil fields at different rates with or without a prior application of Devrinol, which is the registered pre-emergence herbicide on basil. Similar to previous trials, weed control effect, basil plant injury, growth inhibition, and leaf biomass will be evaluated to figure out the efficacy and potential use on basil.

NOTE: The Pyridate herbicide tested in the trials is currently not registered for use on basil in California. The application rates that were and will be tested are for research purposes only and do not necessarily reflect the actual use on your crops. Always follow the herbicide label directions because what's on the label is the law.

Monitoring beet leafhopper population and incidence of curly top virus on processing tomatoes. In 2021, I worked with Dr. Jhalendra Rijal to monitor the dynamics of the beet leafhopper (BLH) population from pre-plant to the end of the season. The goal was to understand the association between leafhopper population and beet curly top virus (BCTV) incidence in the nearby processing tomato fields, and eventually help with the guidance of treating beet leafhopper in the vicinity of processing tomato fields. Results and findings from

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2021 were delivered via popular press journals, newsletters, and pest management meetings. The last parts of the data are being processed.

With the continued support of the California Tomato Research Institute in 2022, Jhalendra and I will continue monitoring the change of BLH and evaluating the BCTV incidence in processing tomato fields. Similar to 2021, nine monitoring locations from Patterson, CA to Crows Landing, CA covering a total of 15 processing tomato fields have been already selected. Three yellow sticky traps at each location were set up on April 4th, 2022, following the same protocol as in 2021 (**Figure 1**). All traps will be checked biweekly for the presence of beet leafhoppers. Old traps will be replaced by new ones and brought back to inspect and count the population of insects collected. In the growing season, we will use sweep netting to catch and collect beet leafhoppers at monthly intervals. In the meantime, visual inspections and lab diagnoses will be conducted to identify and estimate the curly top virus incidence in monitored tomato fields until the end of the season.

What is new from 2021 is that we will conduct within-field spatial analysis of BLH and BCTV distribution over the season by leveraging the grid-based sampling method in tomato fields. Multiple fields with some indications of the BCTV will be selected, and we will conduct 1 – 2 sampling during the time of the peak disease incidence (e.g., June). Depending on the size of the fields, we will utilize a portion of the field (~5-10%) and conduct the visual survey of the disease incidence in 100 sampling spots (10 x 10) by following a grid of 50 ft. x 50 ft. distance. We will take 12 tomato plants from two consecutive rows (6 x 2) at each sample spot. The number of diseased plants (out of 12) for each sampling point with its spatial reference will be recorded and used for semivariogram and Spatial Analysis by Distance Indices (SADIE). More details about the analysis methods will be posted in the future issues of the newsletter. We hope to strengthen the understanding of the relationship between BLH population/BCTV incidence and within-field pest distribution at a field-by-field basis.

Figure 1. Yellow sticky traps were set on April 4th, 2022. Same as 2021, they were wrapped on a utility metal post 3 feet from the ground, faced to the west foothills, and were placed in various landscape and vegetation patterns.

Evaluation of innovative production practices

Watermelon rootstock variety trials. The grafted watermelon project has entered its fourth year since 2019. After a hiatus in 2020 due to COVID-19, the 2021 grafted watermelon trial was conducted to identify rootstock-scion combinations that could out-perform non-grafted plants under wider in-row spacings; in other words, using a fewer plant population. I did get some promising results of the outperformance of certain combinations under a wider spacing, meaning their field performances may be more reliable in terms of productivity, quality, and return on investment, compared to other combinations and non-grafted plants. Results are being shaped and prepared for a journal article.

I noticed a poorly performed rootstock at the beginning of the 2021 season, which was eventually abandoned; however, it is the time to shift the focus to evaluating individual rootstock performance. This is because growers will be more likely to change rootstocks instead of the commercial scion when a particular combination does not work. The need is also triggered by the growing numbers of grafted watermelon acreage in California and commercially available rootstocks for watermelon. I selected 7 commonly used rootstocks for the variety trial in 2022 (Table 1). They represent three types (interspecific hybrid squash, Citron, and *Lagenaria siceraria*). Plants are being prepared and the trial will be planted in late April 2022 (Figure 2). Associated educational and extension activities (e.g., Field Day) will be hosted later in the summer. Stay tuned to the newsletter for updated information.

Table 1. List of rootstocks that will be included in the 2022 watermelon rootstock variety trial.

Rootstock list	**Type**
Carnivor	Interspecific hybrid squash (*Cucurbita maxima* x *Cucurbita moschata*)
Camelforce	Interspecific hybrid squash
Cobalt	Interspecific hybrid squash
Flexifort	Interspecific hybrid squash
RS841	Interspecific hybrid squash
Carolina Strongback	Citron rootstock
Pelops RZ	Bottled gourd (*Lagenaria siceraria*)

Figure 2. Clockwise: germinated rootstock seedlings, germinated scion seedlings, close-up of a finished grafted plant, and grafted plants in the greenhouse.

Optimizing the use of crop biostimulants on vegetable crops. The 2020 UCCE Biologics Educational Webinar invited four speakers to present topics related to the regulation and practical use of different types of crop biologics (biostimulants, plant growth regulators, and entomopathogenic biopesticides). The four webinars attracted over 400 attendees from 16 countries. Now all video recordings have been uploaded to our YouTube channel in 2021 with edited closed captions. You may search "Biologics Educational Webinar" on YouTube or find the link of 2020 UCCE UCIPM Biologics Education Webinar at http://cestanislaus.ucanr.edu/Agriculture/Vegetable_Crops/. I will continue collaborations with biologics companies to conduct evaluation trials of biostimulants on processing tomatoes in 2022.

Optimization of irrigation management

Leveraging CropManage to manage irrigation and nitrogen application for watermelon and processing tomato. Water is precious in the Central Valley. Drought conditions are not alleviated in 2022 despite of early winter precipitation. Applying irrigation and nitrogen based on crop demands at different growth stages is key to maintain vegetable productivity and conserve water quantity. Since 2020, I have been evaluating the adaptability of the irrigation online decision-support tool, CropManage (https://cropmanage.ucanr.edu/), to guide irrigation application and nitrogen fertilization for watermelons. The testing trials were conducted on commercial watermelon fields in the northern San Joaquin Valley. The introduction of CropManage and study results were reported via training workshops, newsletter articles (https://cestanislaus.ucanr.edu/Agriculture/Nutrient_Management_Soil_Quality/), and vegetable industry publications (https://vegetableswest.com/2021/12/01/read-november-december-2021-issue/). I will continue the evaluation of CropManage on watermelon and initiate an additional evaluation on processing tomatoes in 2022. Similar to last year, I will utilize the CropManage to develop crop- (watermelon and processing tomato) and site-specific irrigation and nitrogen management practices through real-time monitoring of water applied, weather-based estimates of evapotranspiration, and measurements of soil water and plant-soil nitrate contents.

II. A New Study in 2022 Focusing on Reducing Soil Fumigation in Watermelon

Research toward potential of reducing soil fumigation in CA's seedless watermelon using grafting and biofungicides. The California Department of Pesticide Regulation (CDPR) funded me this 3-year project (2022, 2023, and 2024) through its Pest Management Research Grants Program in 2021. I will be partnering with the UC Davis Plant Pathology CE Specialist, Dr. Cassandra Swett and her team, as well as the greenhouse nursery and biologics industry representatives. The goal of the project is to investigate the potential of reducing soil fumigation in California's seedless watermelon production using grafting and Trichoderma-containing biofungicides. The rationale is to utilize multi-pathogen resistant watermelon rootstock varieties through grafting and well-documented functions of *Trichoderma harzianum* and *T. virens* fungi on plant fungal disease prevention in order to reduce or eliminate the reliance on traditional fumigation and protect water quality. The first-year field trial will be transplanted in May 2022 on a commercial watermelon field within the Manteca-Stockton-Escalon Triangle in San Joaquin County.

The field trial will include grower's commercial scion grafted onto three different rootstocks (Cobalt, Flexifort, and RS841). Information about the rootstocks can be found at http://www.vegetablegrafting.org/resources/rootstock-tables/cucurbit-rootstocks/ All grafted and non-grafted watermelon seedlings will be treated by either of the two Trichoderma-containing biofungicides via rootball soaking prior to transplanting or in-season chemigation. Vine health conditions, vegetative growth, Trichoderma concentrations, fruit yield, and quality variables will be assessed, measured, and compared among grafted combinations and biofungicide application practice. Possible vine symptoms related to Fusarium and Verticillium diseases as well as root knot nematodes that I will be checking include stunting, wilting, reduced vigor, leaf lesion, chlorosis, stem vascular discoloration, and crown or stem base rot. In addition, I have been sampling watermelon plants from other commercial fields since Fall 2021 for an initial assessment of disease pressure (Figure 3). This will be continued until the end of the project to measure the disease reduction after adopting grafting and/or biofungicide. All deliverables and key announcements will be shared under the regulation of CDPR. Stay tuned to the progress and development of the project.

Figure 3. Watermelon field sampling from commercial fields in northern San Joaquin Valley in September 2021.

Note: Funding for this project has been provided in full or in part through a Grant awarded by the Department of Pesticide Regulation. The contents may not necessarily reflect the official views or policies of the State of California.

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