UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Vegetable Views

Stanislaus County

Spring 2026

Introducing Two New Projects to be Launched in the 2026 Production Season

While continuing the long-term projects of evaluating grafted watermelons, the CropManage irrigation tool, and biocontrol management practices for new and existing diseases in processing tomatoes, our vegetable production team will launch two new projects in 2026 supported by the CDFA-Specialty Crops Block Grant Program. Both projects will serve new groups of clients and potentially benefit a broader range of stakeholders.

I. Optimizing nitrogen management in tomato and Asian vegetables for small-scale farmers with nitrogen-fixing biostimulants.

With the rising costs of nitrogen fertilizers and increasing climatic and environmental dynamics, it is becoming an important practice that sustainable fertilizer applications should fully consider crop demand and fertility level that is already provided by non-fertilizer sources. Many growers have been benefiting from the best utilization of various non-fertilizer sources that can supply nitrogen for crop uptake. Examples include planting legume cover crops (e.g., fava beans, vetches, and clovers), applying animal manure, and crediting crop residues left from the last season. However, there is another important source that is easily overlooked but can contribute to a noticeable portion of crop demanded nitrogen – free-living plant growth promoting rhizobacteria (PGPR). Many species of these soil bacteria are known to fix atmospheric nitrogen gas into nitrate for crop uptake. Different from rhizobia that can only form symbiotic association with legume crops to fix nitrogen (symbiotic biological nitrogen fixation), the free-living PGPR can inoculate roots of a much larger variety of commodities from annual row crops and vegetables to perennials for fixing nitrogen, which is called non-symbiotic nitrogen fixation (Figure 1). Under real farm conditions, these beneficial microorganisms are typically delivered in the form of formulated commercial biostimulant products (Figure 2).

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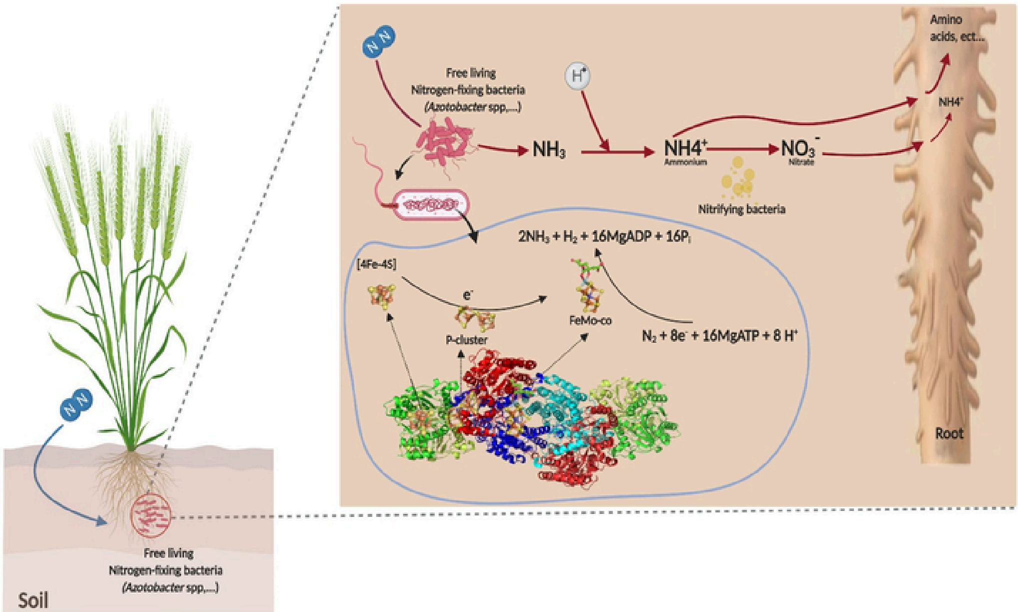

Figure 1. Mechanism of non-symbiotic nitrogen fixation by free-living PGPR with the example of Azotobacter spp. (Source: Aasfar A. et al. 2021. Nitrogen fixing Azotobacter species as potential soil biological enhancers for crop nutrition and yield stability. Frontiers in Microbiology https://doi.org/10.3389/fmicb.2021.628379).

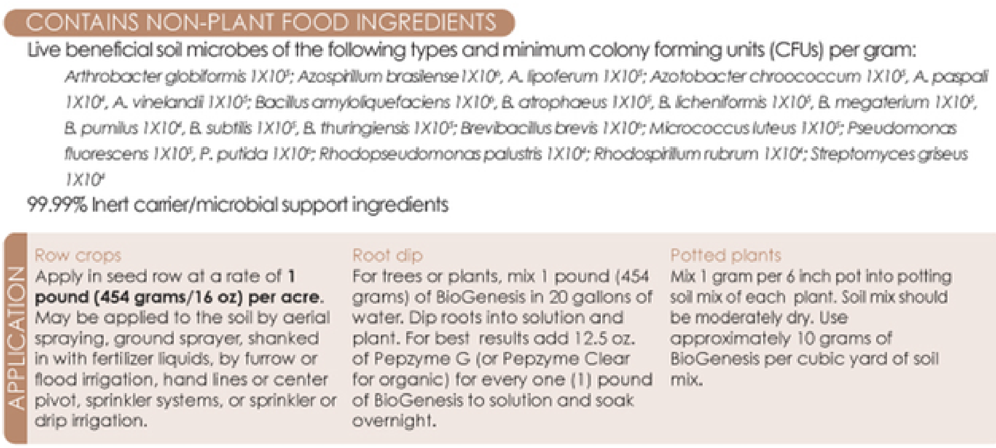

Figure 2. Example of the label of a commercial biostimulant product containing multiple species of beneficial PGPRs.

This project will closely partner with small-farm vegetable growers, including those underserved, to create transferable, science-based information on the best practical use of nitrogen-fixing PGPR biostimulants to improve tomatoes and Asian vegetable production and nutrient management, while also saving on the production cost for synthetic fertilizers. Through implementing carefully designed on-farm collaborative trials, we will help those growers break language and technique barriers and anticipate that they will minimize guesswork on optimal use of microbial biostimulants to improve nitrogen and other nutrient use efficiency while possibly reducing the application of nitrogen fertilizers. Beginning this summer, we will collaborate with selected small-scale growers in the northern San Joaquin Valley to carry out on-farm evaluation trials. While we are figuring out experimental details, Asian vegetables to be included in the trials are Bok choy, long bean, and bitter melons. Tomato, which is the most widely grown vegetable among small-scale farmers, will be included in almost every on-farm trial as a model crop. Stay tuned to our future newsletters for programmatic updates and research progress.

II. Maximizing farmland efficiency by integrating solar radiation and crop production into agrivoltaics farms.

Excessive summer heat increases water and energy costs, stresses farm workers, and damages crops. When crops' heat tolerance thresholds are exceeded, sunscald, stunted growth, wilting, and yellowing of leaves can significantly reduce yield and quality (Figure 3). Common adaptation strategies, such as increasing irrigation to cool plants, transitioning to heat-tolerant crops, or building partial-shade structures, can be costly and impractical for large-scale field production systems.

Figure 3. Sun and heat damage for (A) peppers (UC Davis); (B) burning along the edges of leaves on romaine (UCANR); (C) sun damaged tomato (UCANR); and (D) broccoli leaves

To maximize the output from working lands, we must consider the sun and incoming solar radiation as a resource to better utilize instead of a fixed constraint to deal with. This is where agrivoltaics present a real opportunity for California's growers, given the State's dynamic climate, water shortage, and the abundance of solar radiation.

Agrivoltaics is not only about the co-generation of energy alongside agricultural production but transforming potential risk of excess solar radiation into real opportunities. For example, a conventional acre of a tomato farm will produce only tomatoes, and an acre of a conventional utility-scale solar facility will produce only kilowatt-hour of energy. If well designed and managed, each system can reach its full, or 100%, productivity for that single purpose. In contrast, a carefully optimized agrivoltaics system with low-density solar can produce about 30–40% of the electricity of a utility-scale solar facility while also producing roughly 70–120% of the crop yield of a conventional farm, depending on the crop and its tolerance to shade. Because food and energy are produced on the same acre, the combined land productivity can far exceed the 100% benchmark. This means that 10 acres managed under agrivoltaics can produce more output than 10 acres of conventional farmland and/or utility-scale solar.

Beginning this summer, our vegetable production team will be collaborating with scientists from UC Davis (Drs. Andre Daccache and Majdi Abou Najm) on a project supported by the CDFA Specialty Crop Block Grant Program to demonstrate the practicality and economic sustainability of various agrivoltaics systems and evaluate changes in the agronomic performance of processing tomatoes and cabbage as model crops. The project will involve four different types of 50-kilowatt multi-technology agrivoltaics facilities built on the UC Davis Research Farm to test how different crops perform under real farm conditions with different agrivoltaics configurations and solar technology (Figure 4).

The north-south vertical bifacial solar configuration (Figure 4A) is practical and cost-effective as it does not require elevated structure for machinery passage. Vertical bifacial systems also generate electricity with two daily production peaks providing kilowatt-hours during more crucial times compared to the traditional tilted panels that only peak at noon. Furthermore, vertical systems can serve as effective wind barriers to protect young plants from wind lodging and sunburn. The second and third sub-systems utilize two different single-axis racking solar panel technologies along with bifacial solar panels (Figure 4B and 4C), also in a north-south orientation so they can track the sun from east to west. While typically optimized to maximize solar energy capture, they can be programmed to alter the shading level depending on crop needs. They can also be tilted away when farm machinery is operating, allowing the panels to be installed at a medium height for cost-effectiveness and flexibility. Finally, the fourth sub-system consists of a fixed-tilt array with spectrally selective solar panels that allow low-energy photons (primarily in the red-light spectrum) to reach crops while converting high-energy photons (such as green and blue light) into electricity (Figure 4D). This innovative agrivoltaics configuration enables testing of crop performance under optimized light quality conditions.

Project progress and results will be shared through interactive workshops, seminars, and site visits. This research will help answer key questions about agrivoltaics such as its role in supporting agricultural productivity, conserving water, producing food sustainably, enhancing economic profitability, and strengthening grower resilience. Furthermore, agrivoltaics has the potential to enable small-, medium-, and large-scale growers to develop value-added services by providing affordable and accessible on-farm energy.

Figure 4. Four different agrivoltaics technologies are simultaneously utilized to assess agrivoltaics feasibility at UC Davis: (A) 50 KW vertical solar system with bifacial panels; (B and C) two 50 KW systems utilizing two different single-axis racking system along with bifacial solar panels; and (D) 50 KW fixed-tilt with spectral-selective solar panels (Imagines were provided by Dr. Majdi Abou Najm at UC Davis).

Upcoming Events

2026 CropManage Training Workshop

All are welcome to learn and use CropManage, an Irrigation & Nutrient Management Decision Tool

Date: Wednesday, March 11, 2026

Time: 12:30 pm – 5:00 pm

Location: UCCE-Stanislaus County, Harvest Hall, Room A-C, 3800 Cornucopia way, Modesto, CA 95358

SIGN UP TODAY!

https://surveys.ucanr.edu/survey.cfm?surveynumber=48669

- *Learn the function of CropManage to support irrigation and nutrient management decisions via hands-on, step-by-step operations.*
- *Introduce recent updates on new features and functions.*
- *Participate in discussions on using CropManage to support your irrigation and nutrient management.*
- *Review your past use and share experience as current users.*

Questions?

Dr. Zheng Wang
zzwwang@ucanr.edu or
209-525-6822

2026 ADVANCED SCHOOL ON MICROIRRIGATION FOR CROP PRODUCTION

Class Lectures: March 30 - April 1
Field Trips: April 2-3

Class lectures will be held in the UC Davis Conference Center. Field trips will be in the San Joaquin Valley and Central Coast of California

ATTENDING THIS SCHOOL WILL PROVIDE:

- *3 days of practical class lectures on principles and implementation of microirrigation systems and management practices for crop production.*
- *2 days of field demonstration visits (one day in the San Joaquin Valley for modernized irrigation delivery systems and fruit and nut crops; one day in the Central Coast for vineyards, vegetable crops, and berries)*

Questions?

PLEASE CONTACT US

- Daniele Zaccaria - UC Davis: dzaccaria@ucdavis.edu
- Mary Ann Dickinson: maryann@dickensonassociates.com

Instructors of the School are professionals with extensive experience on principles and practical applications of microirrigation for resource-efficient crop production.

WHAT YOU WILL LEARN:

- Technical aspects of water delivery systems to allow for successful adoption and management of microirrigation systems.
- Soil-water movement and soil-plant-water relations with microirrigation
- Microirrigation systems design, operation, maintenance, automation, and performance evaluation.
- Methods and tools for microirrigation scheduling.
- Managing microirrigation for different crops (field and agronomic crops; berry crops; fruit crops; nut crops; vineyards)
- Chemigation and fertigation
- Salinity management with microirrigation