Project No: 24-0474

A science-based and interactive website for nutrient management in organic crop production

Project Leader: Daniel Geisseler
UC Davis
djgeisseler@ucdavis.edu

Abstract

Nutrient management in organic systems is complex and can be challenging for several reasons. First, organic growers predominantly apply nutrients with organic inputs, such as composts, organic fertilizers, and cover crops. Most of the nitrogen (N) in these materials is not directly crop-available and needs to be mineralized first by soil microorganisms. How much is mineralized and when N is mineralized depends strongly on the properties of the material, especially its carbon (C) to N ratio, but also on environmental conditions such as soil temperature and moisture. Second, an increasingly large number of fertilizers is available for organic agriculture. The availability of the N applied with these amendments can range from zero or even N immobilization to up to 90% Accurate data to estimate N availability is crucial to achieving high N use efficiency, decrease losses with potentially harmful environmental effects and make organic production economically viable. Furthermore, composts and most organic amendments contain many different macro- and micronutrients. Finding amendments or combinations of materials that match the crops' demand for different nutrients is more challenging than using single-nutrient fertilizers. Since their creation some ten years ago, the online California Fertilization Guidelines have become an important source of information for growers and crop consultants in California.

Project Objectives

Specific objectives are:

1. Summarize the available literature with a focus on studies from California and create webpages for organic nutrient management.

2. Develop an interactive tool to calculate field-specific N, P and K budgets.

3. Fill knowledge gaps and validate the estimates of the calculator in field trials.

4. Conduct outreach to growers, consultants, and other stakeholders.

5. Develop a robust extension program and effectively communicate with growers, agricultural scientific community and interested groups on best irrigation and N management practices

Project No: 24-0475

Determination of crop N-removal coefficient values for the Imperial and Coachella Valleys cropping systems

Project Leader: Ali Montazar

UCCE Imperial County
amontazar@ucanr.edu

Abstract

Nitrogen (N) balances in agricultural fields are an important component of the Irrigated Lands Regulatory Program (ILRP) in California. One key metric to assess grower progress by the ILRP in improving N management is the ratio and/or difference of applied to/or from removed N in harvested crop biomass. Accurate crop N-removal coefficient values for different crops are crucial to estimate the amount of N removed in harvested product. The crop coefficient values have been updated for several commodities in the Central Valley and the Central Coast while The lack of this information for the desert region has caused a big concern for growers and both the Imperial Valley Irrigated Land Coalition (IVILC) and the Coachella Valley Irrigated Land Coalition (CVILC). The IVILC and CVILC are currently under pressure by the Colorado River Basin (CRB) Regional Water Board, Region 7, regarding the request for developing the coefficient values for crops that represent 95% of the acres in the Imperial and Coachella regions. The feedback received from growers in the low desert and the special requests from the IVILC and the CVILC convinced the research team that updating crop N-removal coefficient values is a regional immediate need.

Project Objectives

The specific objectives of this study are:

1. To document seasonal nitrogen/phosphor/potassium applied and assess N, P, and K uptake and removed in harvested product for 10 commodities identified.

2. To develop reliable information and values of the crop N-removal coefficient for crops that cumulatively occupy more than 70% of the agricultural production acreage in the Imperial and Coachella Valleys.

3. to disseminate knowledge and information developed by the project to growers, CCAs, farm advisors, and consultants in the region.

Project No: 24-0476

Monitoring and assessing variability of nutrient status in almond orchards with hyperspectral satellite imagery empowered by artificial intelligence

Project Leader: Yufang Jin

UC Davis
yujin@ucdavis.edu

Abstract

The ability to rapidly, cheaply and effectively monitor infield nutrient status is central to the optimization of nutrient management and yield optimization. Traditional leaf and soil samples are, however, far too slow and expensive to achieve this goal. While remote sensing and ground based optical sensing have long 'promised' to resolve this issue, there has to-date been relatively little progress. This is, however, changing rapidly. The confluence of new emerging hyperspectral satellite missions and greatly improved satellite multi-spectral imagery, new AI technologies, the availability of large data sets of tree nutrient status, and the ability to collect high resolution yield provides a unique opportunity to develop practical and cost-effective remote sensing approaches to nutrient mapping. This project brings together practical plant nutrition and horticultural expertise with expertise in spectral imaging, remote sensing, and AI modeling to address this substantial challenge and to build the framework for the development of a viable and practical alternative to leaf sampling to support field nutrient management and tree productivity.

Project Objectives

Specific objectives are to

1. Develop an integrated approach to monitor nutrient status using hyperspectral satellite imagery and artificial intelligence in almond orchards.

2. Examine the spatial patterns and temporal dynamics of essential hyperspectral features, canopy nutrient status, and their associations with soil properties and yield.

3. Develop novel field sampling strategies guided by hyperspectral imagery to allow growers and consultants to determine orchard nutrient status and variability.

4. Develop multi-modal extension and outreach programs for knowledge dissemination, stakeholder feedback, and technology transfer.

Project No: 24-0477

Development of Three Citrus Modules in The Decision Support Tool CropManage for Orange, Mandarin, and Lemon

Project Leader: Ken Miller

Southern San Joaquin Valley Management Practices Evaluation Program
kmiller@formationenv.com

Abstract

As citrus growers in California's Central Valley grapple with significant water quality and quantity issues, the need for precise fertilization and irrigation practices is more critical than ever. Currently, citrus growers in the valley lack access to a specialized, free decision-support tool that could guide them in making informed decisions about irrigation, fertilizer, and water application. The crops' physiological characteristics are unique amongst commodities grown in the valley, adding a layer of complexity to developing such a tool. The goal of this project is to build a decision-support tool to address this need. This project builds off years of research, experimentation, and software development efforts and will culminate in the development of three new citrus-specific modules for UC's CropManage online platform (for oranges, mandarins, and lemons). To do so, we aim to first enhance our understanding of nitrogen and water use dynamics in micro-irrigated citrus orchards through field-data collection, then iteratively refine and improve the experimental versions of three, citrus-specific CropMange modules. These improvements will be informed by insights gained from field studies and modeling efforts. Once released to the public, CropManage citrus modules will provide accurate, reliable recommendations for nitrogen and water application to Citrus Orchards throughout the Central Valley.

Project Objectives

1. Improve the understanding of nitrogen and water use dynamics in micro-irrigated citrus orchards grown under the atmospheric conditions of the San Joaquin Valley and Tulare Lake Basin, through field measurements, monitoring, and data-driven modeling.

2. Refine the experimental version of three citrus modules (orange, mandarin, and lemon) within CropManage with knowledge gained from field studies and modeling.

3. Ground-truth CropManage recommendations for nitrogen and water applications at heavily monitored citrus study orchards.

Project No: 24-0478

Equity in Nutrient Management Education on the Central Coast of CA

Project Leader: Nathan Harkleroad

Agriculture and Land-Based Training Association
nathan@albafarmers.org

Abstract

The Agriculture and Land-Based Training Association, a 501(c)3 non-profit based in the Salinas Valley, will carry out a project entitled, “Equity in Nutrient Management Education on the Central Coast of CA”. This project focuses on practices that help reduce environmental issues, particularly groundwater contamination with nitrates, as well as increased access to knowledge and resources on nutrient management for socially disadvantaged farmers (SDFs), and a wider community of Agricultural Science college students, and service providers. The objectives include educating 175 + SDFs, 30 college students, and another 25 agricultural professionals/service providers on soil fertility and plant nutrition management techniques; direct technical assistance to 60+ SDFs on the use of innovative and proven conservation practices that protect groundwater resources; and performing outreach 500+ SDFs, college students, and agricultural professionals on project results and CDFA, UCCE, and other agencies’ tools and resources for nutrient management best practices. The project will directly impact 225 participants and 600+ acres of farmland on the Central Coast. Key results will include: 150+ SDFs gain knowledge on innovative and proven irrigation and nutrient management techniques; 30-50 SDFs implement new management practices; 1,000+ participants receive project updates, and bilingual nutrient and irrigation management resources through text, e-mail and social media; and 60+ participants learn about project through webinars and presentations at conferences.

Project Objectives

1. Educate 175 + SDFs, 30 college students, and another 25 agricultural professionals/service providers on nutrient management best practices and techniques

2. Direct technical assistance to 60+ SDFs on the use of innovative and proven conservation practices. These activities will achieve the following results

3. Outreach to 1,000+ SDFs, college students, and agricultural professionals on project results: CDFA, UCCE, and other agencies’ tools and resources for soil fertility and plant nutrition decision making.