Project No: 21-0502

Targeted Nitrogen and Irrigation Education in California's Nitrate Impacted Regions

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Abstract

There is an urgent need for more in-person assistance at the field level to help growers in Central Valley with implementing more efficient irrigation and nitrogen management practices and to increase their awareness and knowledge of how their operations will be impacted by water quality regulations. This is a collaborative effort between and University of California Cooperative Extension (UCCE) to directly provide education and training to growers in the Central Valley and Central Coast. UCCE will hire five staff whose work will be fully devoted to this purpose through demonstration projects, on-site training, and workshops. These staff will be directed to collaborate with local grower coalitions to focus resources on the highest priority areas, crops, and growers, as determined by analysis of coalition nitrogen reporting data and other information.

Project Objectives

- Hire and train five field staff, who will be supervised by UCCE farm advisors, to work across 12 counties and subregions most impacted by groundwater nitrate including Fresno, Tulare, Kings, Kern, Merced, Madera, Stanislaus, San Joaquin, Monterey, Santa Cruz, Santa Clara, and San Benito.
- Identify farming operations in 12 counties who risk non-compliance with water quality regulations due to excess nitrogen applied and reported on INMP.
- In each county, increase knowledge of targeted growers of water quality regulations and limits to excess nitrogen applications.
- Improve targeted grower understanding and implementation of best nitrogen and irrigation management practices. Assess opportunities to increase irrigation and nitrogen efficiency and assist growers with farm specific recommendations and implementation options.
- Implement on-farm trials that demonstrate and promote locally appropriate best irrigation and nitrogen management practices to accelerate understanding and acceptance.
- Track improvements in nitrogen and irrigation efficiency on participating farming operations.
- Evaluate and report program activities and progress.

Project No: 21-0573

Nutrient Management and Irrigation Efficiency Outreach and Education for Latino and Southeast Asian Farmers

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Abstract

Adopting changes for optimal nutrient management and irrigation efficiency is inherently complicated as it depends on crop types with different nutrient and water needs and timing, multiple site-specific factors (e.g., soil characteristics, slope, irrigation system), and climate (e.g., rainfall, temperatures). Furthermore, social and economic barriers and inequitable technical assistance (TA) provision hinders management changes among farmers. Farmers are typically risk averse and management adjustments can lead to uncertainty, a barrier to enhancing nutrient management and irrigation efficiency. This is harder to overcome in communities that lack TA services. Many California producers do not speak English as a first language and therefore receive TA at lower rates than their English-speaking counterparts. Lack of TA delivery with linguistically and culturally proficient service providers familiar with production practices of small-scale diversified vegetable systems, coupled with historical uneven distribution of services across ethnic and racial groups, and risk aversion inherent in farming, prevents California agriculture from realizing its nutrient management and irrigation efficiency potential.

Project Objectives

1. Increase nutrient management and irrigation efficiency TA services and information distribution for underserved farmers.

2. Increase management efficiencies and adoption of sustainable nutrient management and irrigation efficiency practices.

Project No: 21-0586

Nitrogen Fertilizer and Irrigation Best Management Practices for the Low Desert Sudangrass Production Systems

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Abstract

Sudangrass hay immensely contributes to the agricultural economy of California. We propose to develop improved N and irrigation management strategies for sudangrass production in the low desert. The improved N management will be based on soil and tissue nutrient analysis as a basis of subsequent nutrient supply. Crop derived nutrient supply will create efficient use of N by providing a steady state N supply and allowing crop luxury nutrient consumption. The improved practice reduces N loss to the environment and yields a crop with desirable nutrient level attracting a robust foreign export market. Growers would ultimately benefit from the practice by maximizing their economic benefits from growing quality hay while significantly balancing ecological impacts that arise from inappropriate fertilization practices.

Project Objectives

1. Determine the optimum level of N and methods of fertilizer delivery for luxury or steady state nutrient consumption of sudangrass with a high hay quality.

2. Assess hay yield and economic benefits of the N fertilization practices.

3. Assess N leaching from sudangrass fields as affected by irrigation types and fertilizer delivery systems available in crop root zone for uptake.

4. Develop a robust extension program and effectively communicate to growers, agricultural scientific community and interested groups on best irrigation and N management on environmental

Project No: 21-0587

Optimizing Nitrogen Fertilizer Concentrations in Vegetable Transplant Production

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Abstract

Currently, there are no clear nitrogen (N) fertilizer application guidelines for the diverse range of vegetable transplants produced in California. For example, soluble N recommendations for lettuce range from 60-600 ppm. Extension publications have general recommendations, such as providing more N for solanaceous and less for cucurbit crops. However, these same extension publications on vegetable transplant production revealed similarly broad recommendations ranging from 15-100 ppm N without specific guidelines for individual crops. To provide clarity for vegetable transplant producers, we propose evaluating N uptake of the top five vegetable transplant crops in California. To elucidate optimal N concentrations for the top vegetable transplant crops, we will measure total plant N uptake and water use to calculate optimal nutrient solution N concentration.

Project Objectives

1) Determine nitrogen requirements for top five California vegetable transplant crops.

2) Convey results to transplant growers through publications and presentations.

Project No: 21-0588

Quantify and Model Overlooked Pathways of Nitrogen Loss From Organic Inputs Across Contrasting Soil Types

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Abstract

There is emerging evidence that leaching of dissolved organic N (DON) from organic inputs could be a considerable, but overlooked, N loss pathway. While leaching of DON has been recognized for the last 100+ years, most agricultural field studies do not take this loss pathway into account and most models applied to agricultural settings do not include DON leaching as a possibility. This leads to a lack of full N accounting in N budget construction for agroecosystems, which, in systems with organic inputs, could potentially significantly underestimate N loss. On average almost one third of N losses across agricultural systems were in the form of DON. While much of the concern over the consequences for human health have focused on nitrate in drinking water, DON could act as a source of nitrate in groundwater as it is mineralized and on its own can be harmful to human consumption due to the formation of disinfection byproducts. This project proposes to understand how compost application at varying rates interacts with soil edaphic properties to influence both inorganic and organic N retention and loss dynamics in agricultural landscapes within California's Central Coast.

Project Objectives

Our ultimate aim is to assist growers, farm managers, and water quality regulators to determine the correct amount and timing of compost amendments suitable for their specific soil type, while preserving groundwater quality. Our project will be the first steps toward a long-term goal of developing a user-friendly software tool by integrating a crop-ecosystem model into a nutrient management accounting tool like CropManage, similar to the COMET-Farm tool, which interfaces with the ecosystem model Daycent for carbon accounting.

Project No: 21-0594

Distributed Water and Fertilizer Delivery for Minimizing Nitrogen Losses by Leaching and Volatilization

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Abstract

Nitrogen loss from agricultural soils via leaching and volatilization is a major economic and environmental challenges including groundwater pollution, poor-air quality, and contribution to climate change. Many of the environmental challenges afflict communities that are already disadvantaged due to low economic status and lack of adequate access to health care. A core reason for N loss in irrigated agriculture is that high soil moisture status, which is important for crop performance) also contributes to high rates of leaching and volatilization of plant available forms of N. Thus, the N use efficiency in the US and globally has stagnated or showed only modest increase since the 1960s.

Project Objectives

The overall goal of this project is to test a novel and nutrient and water management strategy that directly addresses the core challenge of N loss. The strategy takes advantage of the innate capacity of plants to extract nutrients and water from separate regions within the rooting zone. This proposed study builds upon a recently concluded indoor pot-study, in which we conclusively demonstrated that tomato plants can acquire 100% of their nutrient requirement from dry patch of soil (0.5-1.0 MPa), as long as water is available in sufficient quantity to meet their transpiration demand elsewhere. In this proposed project we will address whether (1) nutrient plumes can be effectively isolated from the fast-moving rootzone water, (2) crops can access water and nutrients from disparate locations without loss in productivity, and (3) the proposed mechanism cuts down fertilizer losses by 50% or more.