A. Cover Page

1. Project Title

Promoting the Adoption of Soil Nitrogen Quick Tests by Spanish-speaking Operators on Strawberry Ranches in Santa Cruz and Monterey Counties, FREP Proposal 2018

2. Project Leaders

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5. CDFA Funding Request Amount

Project funding requested from FREP is $ 55,446.53 for the year 2019 and 66,093.29 for the year 2020, totaling $121,539. The NRCS Capitola office will provide vehicles and fuel needed for the field work of the project for approximately 100 miles per week for two years, for a total estimated miles of 10,400 corresponding to $ 5,616. Richard Smith and Dr. Michael Cahn from the UCCE of Monterey County will provide match in the form of technical consultation for the technical advisory committee and will speak at grower workshops for a total of $ 10,000.

6. Agreement Manager

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B. Executive Summary

1. Problem

Over-application of nitrogen fertilizer in strawberry production on the Central Coast of California reduces the profitability of the crop and results in nitrate leaching and negative effects on the environment. Studies have indicated substantial potential for nitrate leaching due to rains during winter months and during spring and summer due to over-irrigation. Local efforts have been made to educate growers on limiting fertilizer over-application, however, fertilizer application decisions are often made by Spanish-speaking operators and the management tools that have been developed target an English-speaking audience, resulting in limited adoption amongst this demographic.

2. Objectives, Approach, and Evaluation

The project goal is to promote the adoption of management practices that optimize the use of nitrogen fertilization. Printed guidelines in Spanish and English will be produced on how to collect and process a soil sample and how to perform a Nitrate Quick Test. Soil Nitrate Quick Tests have been shown to be an accessible, fast and reliable field method to assess the amount of nitrate available to the crop and to improve nitrogen management in strawberry and coastal vegetables. The guide will indicate the amount of pounds of nitrogen per acre required by the crop based on the test results. The recommendations will be given in tables and charts and no calculations will be required by users. Guidelines will recommend nitrogen management based on soil nitrate availability for the first management phase (winter-early spring months) and based on crop nitrogen uptake curves for the production months (March to October). The main approach to encourage adoption is to provide one-on-one field assistance leveraging the long-standing relationships that the RCD of Santa Cruz County has developed with the Spanish-speaking agricultural community of the Pajaro Valley. The criteria that will be used to evaluate the project’s success: 1) guidelines in English and Spanish are printed and distributed, 2) Field assistance is provided over two growing seasons to at least 10 growers and/or irrigators, 3) Surveys in Spanish are completed with participating growers evaluating management practice adoption and project effectiveness.

3. Audience

This project will benefit primarily Spanish-speaking growers, ranch managers and field operators in Santa Cruz and Monterey Counties. The guidelines produced can also be distributed to the larger agricultural community as nitrogen fertilizer application is not region-specific.

C. Justification

1. Problem

In 2017 approximately 7,500 acres of strawberry were planted in the Watsonville-Salinas area and produced a crop value of $900M (Source: Strawberry Commission). Needless to say, strawberry production is extremely important to the economies of Santa Cruz and Monterey Counties. However, over-application of nitrogen-based fertilizer in strawberry production is
widespread throughout the region, which reduces crop profitability and contributes to severe nitrate pollution of water resources (causing detrimental effects to human health and the natural environment). Not all growers are aware of these regional problems and some are unaware that they over-fertilize. If growers are not provided with information on how to improve their on-farm practices, they could forgo profits and face future repercussions from increasingly stringent water quality regulations.

Many strawberry growers and the majority of field operators are Spanish speakers (a recent Strawberry Commission survey indicated that 29% of all growers and 90% of all irrigators only speak Spanish). As a result, most fertilizer application decisions are made by Spanish speakers. However, management tools that have been developed to support efficient on-farm practices are written in English which results in limited adoption amongst the Spanish-speaking demographic.

Identified barriers to the adoption of Soil Nitrogen Quick Tests include:

a) **Lack of a guidelines written in Spanish** on how to collect, process and analyze a soil sample.
b) The existing published guides require following mathematical equations to interpret the soil test results and to calculate the amount of nitrogen fertilizer that one needs to apply; a potentially intimidating process for certain operators.
c) The operators go through an initial learning period in which they develop trust for the new tool and require field assistance to validate the interpretation of the test.
d) The current recommended management practice involves dividing the crop cycle into two phases (roughly corresponding to vegetative and production stages) managing nitrogen fertilization differently depending on the phase. So different thresholds of soil nitrate concentration are recommended depending on the crop stage, but some growers manage nitrogen in the same manner through the year.

2. **FREP Mission and Research Priorities**

This project will improve input management by addressing challenges and barriers to adoption of management practices. Studies (Bottoms et al., 2013) have indicated substantial potential for nitrate leaching during winter months and highlighted the need of soil nitrate monitoring during winter and early spring. New requirements from regulatory agencies have brought these issues to the attention of growers and tools have been developed (e.g. Soil Nitrogen Quick Tests (SNQT) and CropManage) to aid in decision making with regard to nitrogen management. However, education and outreach efforts benefiting Spanish-speakers aimed at encouraging the adoption of these tools is lacking. This project will contribute to FREP’s mission of advancing the environmentally safe and agronomically sound use of fertilizing materials through educating strawberry growers on nutrient optimization.

3. **Impact**

Improved nitrogen management in strawberry cropping systems will potentially decrease the quantity of nitrate leached to groundwater and lost to runoff contributing to freshwater pollution.
ecosystems and groundwater quality improvement. In organic cropping systems, where yields are lower than in conventional systems, precise nitrogen management may result in higher yield and more profitable operations.

4. **Long-Term Solutions**

The project will provide equipment and assistance for field operators to learn how to take soil samples, process and interpret them to guide fertilizer application decisions. When growers see the value of implementing efficient practices, they will likely continue to farm this way into the future. The project has the potential to increase the number of growers that employ sampling-based nitrogen management strategies. Further, the project has the potential to disseminate the adoption of seasonal nitrogen balance calculations and tracking among a historically underserved demographic.

5. **Related Research**

Bottoms et al., (2013) and Bottoms et al., (2014) have described the dynamics of nitrogen in strawberry production on the Central Coast, and Hartz (2012) proposed nitrogen management practices. These were further refined by Cahn (unpublished) and included in the models used in the web application CropManage. A summary of fertilizer management practices is published in the FREP Strawberry Fertilization Guidelines at [http://apps.cdfa.ca.gov/frep/docs/Strawberry.html](http://apps.cdfa.ca.gov/frep/docs/Strawberry.html).

6. **Contribution to Knowledge Base**

Although this is not a research project, it has the potential to generate data on the quantities of nitrogen currently being applied by strawberry growers in conventional and organic systems. Additionally, yield data may be anonymously collected in the final surveys and related to improved nitrogen management. User-friendly nitrogen use efficiency guidelines in English and Spanish will also contribute to conveying current information to a wider agricultural audience.

7. **Grower Use**

In-field technical assistance in Spanish to improve nitrogen management is in high demand among strawberry growers. Substantial monetary savings are achievable by reducing over-applications of nitrogen fertilizer, particularly in organic systems and for conventional growers that use slow-release pre-plant fertilizer. Improved yields are expected from meeting the crop uptake requirements in the late part of the production season (July-August). There is anecdotal knowledge among growers that excessive nitrogen fertilization makes the fruit soft, decreasing its quality, particularly during warm periods and with abundant irrigation. In these circumstances, considerable improvement in fruit quality is expected to result from careful monitoring of soil nitrogen availability.

D. **Objectives**

1. **Produce a printed guide for taking soil nitrate quick tests in Spanish**
A guide detailing procedures to take a soil nitrate quick test will be produced, in Spanish and English, including where to buy the tools and materials for the quick test, how to make the test solution, how to collect the soil sample and how to perform the test. Initially, test strips and reagent solution will be provided to interested growers for free. The guide will include a step-by-step explanation with pictures and a simple graphic method to interpret the test result, indicating the pounds of nitrogen per acre that need to be applied to the field.

2. Provide in-field technical assistance to irrigators on how to perform and interpret soil nitrate test

The project will provide in-field technical assistance in Spanish to at least 10 ranches in Santa Cruz and Monterey Counties. At least five visits will be provided to each ranch with the objective of gradually training the irrigator to use the guide to take a soil sample and interpret it.

3. Organize workshops to share grower experience and to encourage peer-to-peer learning

Two workshops will be organized at the ranches of successful adopters to share the growers’ experience with soil sampling.

4. Project Evaluation

During the final visits to the ranches, a survey in Spanish will be completed to evaluate the degree of adoption of soil sampling and trends in behavior or perception of nitrogen management.

E. Work Plans and Methods

1. Work Plan

For Objective 1: Produce a printed guide for taking soil nitrate quick tests in Spanish
   Task 1.1: Prepare a draft of the guide in English
   Task 1.2: Convene a technical advisory meeting to discuss the draft with project leaders and collaborators and seek input from experts
   Task 1.3: Complete the guide and translate it in Spanish
   Task 1.4 Discuss the guide with collaborating growers
   Task 1.5 Finalize the guide, print it and distribute it. This task will be carried out in the first 3 months of the project and will be completed by the end of March 2019.

For Objective 2: Provide in-field technical assistance to irrigators on how to perform and interpret soil nitrate tests
   Task 2.1: Site assessment
   Task 2.2: Providing tools and materials to irrigator and first training to take and process soil sample
   Task 2.3: Follow-up visits to assist with interpretation of the test results and assess the impact of nitrogen management on yield and fruit quality. This task will continue for the entire length of the project, the frequency of the visits will be adjusted based on the successful adoption of the soil nitrate test.
For Objective 3: Organize workshops to share grower experience and to encourage peer-to-peer learning
Task 3.1: Organize workshops at the ranches of successful adopters with participation of growers and experts form the UC Cooperative extension. Two workshops will be organized, one in 2019 and one in 2020.

For Objective 4: Project evaluation
Task 4.1: Perform in-farm surveys with the irrigators participating in the program to assess changes in fertilization management strategies. This task will be completed during the final site visit to each farm.

2. Methods
The main method used in this outreach project is providing one-on-one trainings in the field to irrigators. The main adoption barriers (lack of equipment and materials and lack of easy-to-interpret instructions in Spanish) will be targeted by providing tools and materials to the irrigators for free and by producing a soil nitrate test guide written in Spanish.

3. Experimental Site
The project will take place at commercial strawberry production ranches, organic and conventional, located in Santa Cruz and Monterey counties.

F. Project Management, Evaluation, and Outreach

1. Management
G. Spinelli will write the guide and provide technical assistance in the field.
R. Smith will lead the technical evaluation of the guide and will participate to the workshops.
M. Cahn will be part of the technical evaluation of the guide and will be a key speaker at the workshops.
5. Lozano will manage the grant, translate the guide and other educational materials into Spanish and will be the translator at the workshops.

W. Haraguchi will provide assistance to the project in the form of vehicles and fuel as part of the NRCS-RCD partnership.

Coordination will be promoted during technical advisory committee meetings to evaluate the guide.

2. Evaluation

The success of the project will be evaluated by completing final surveys with the growers and irrigators that participated in the program. The key information to be surveyed will be: a) whether or not the irrigator adopted the soil nitrate test as an ordinary management tool, b) if the seasonal applied nitrogen and the application timing has changed as a result of adoption, c) the yield and fruit quality has changed as a result of adoption.

3. Outreach

The three outreach activities of the project will be two workshops organized at the ranches of participating growers and one article in a local journal accessible by growers (farm bureau newsletter or trade journals). One workshop will be organized for each year of the project. The workshop will give the opportunity to participating growers to share their experiences with others, encouraging peer-to-peer learning. The workshops will be in Spanish. Additionally, to improve the visibility of the project, signs will be placed at the entrance of each participating ranch acknowledging FREP funding and the grower’s participation in the program.

G. Budget Narrative

a. Personnel Expenses

**Wages Total = $ 75,228.16:**

Dr. Gerry Spinelli, Agricultural Specialist. The Agricultural Specialist will spend an estimated 10.01 hours a week for 24 months, (0.25 Full Time Equivalent [FTE]) for a total of 1040 hours at a rate of $54.64/hr. He will oversee and participate in the execution of all tasks, coordinate with partners and growers, provide technical assistance in the field and produce the guide and manage data to complete the proposed work plan for a total of $56,825.60.

Year 1: $22,730.24; Year 2: $34,095.36; Total: 1040 hours ($54.64) = $56,825.60

Sacha Lozano, Program Manager. The Program Manager will spend an estimated 2 hours a week for 24 months (0.05 FTE), for a total 208 hours at a rate of $62.73/hr. He will manage the grant and oversee of aspects of the agreement between RCD and CDFA-FREP for a total of $13,047.84.

Year 1: 6,523.92; Tear 2: 6,523.92; Total: 1040 hours ($62.73) = $13,047.84

Karl Fieberling, Grant Administrator. The Grant Administrator will spend an estimated 0.87 hours a week for 24 months (0.022 FTE) for a total of 90 hours at a rate of $54.64/hr. He will prepare and submit invoices to funder and assist with the management of grant, for a total of $4,917.60.
Year 1: $2,458.80; Year 2: $2,458.80; Total: 90 hours ($54.64) = $4,917.60

Angie Gruys, Communication Specialist. The Communication Specialist will spend an estimated 0.08 hours a week for 24 months, (0.002 FTE) for a total of 8 hours on the project at a rate of $54.64/hr. She will work with the graphic design and production of the guide and the signs, for a total of $437.12.
Year 1: $437.12; Total: 8 hours ($54.64) = $437.12.

**Benefits Total = $28,353.49:**
Dr. Gerry Spinelli, Agricultural Specialist, will receive fringe benefits at a rate of 37.69% for a total of $21,417.57. Year 1: $8,567.03; Year 2: $12,850.54.

Sacha Lozano, Program Manager, will receive fringe benefits at a rate of 37.69% for a total of $4,917.73. Year 1: 2,458.87; Year 2: 2,458.87.

Karl Fieberling, Grant Administrator, will receive fringe benefits at a rate of 37.69% for a total of $1,853.44. Year 1: $926.72; Year 2: $926.72.

Angie Gruys, Communication Specialist, will receive fringe benefits at a rate of 37.69% for a total of $164.75. Year 1: $164.75.

**b. Operating Expenses**

**Operating Expenses Total $7,600**

- **Supplies:** Total = $3,000.00
  Nitrate Quick Test Kits (colorimetric NO₃ test strips MQuant™) – Kits include: Nitrate test strips, calcium chloride dihydrate solution, plastic squirt bottle, centrifuge tubes, laminated instructions. 10 kits (1 per grower) at $100/kit will be required in year 1, for a total of $1,000. 1 kit x $100/kit, Total = $1,000.
  Soil Probes (AMS Samplers, 7/8” x 33”, stainless, includes ejector) for collecting soil samples, 1 probe per grower for 10 growers in years 1 for a total of $1,500. 1 probe/grower x 10 growers = 10 probes ($150), Total = $1,500.

  Printing of 90 guides, full color, 11”x17”, 4 pages, with bleeds, $2 per guide x 100 guides = $200.

  Publication fees in local newsletter/trade journal, $300.

- **Travel:** Total = $400
  Travel to the FREP conference for Gerry Spinelli or Richard Smith to present the project results: hotel room, 2 nights x $200/night = $400.

- **Other Expenses:** Total = $4,200
  FREP Conference fee: conference fee = $200.
  Site rental for workshop: $1,000 x 2 workshops = $2,000.
  Signs to improve the visibility of the project: $100 x 20 = $2,000.
c. Other Funding Sources

Travel for Gerry Spinelli to ranches to provide technical assistance, roundtrip 100 miles per week for 2 years = 100 miles x 52 weeks x 2 years = $5,616. Round trip to the FREP conference 300 miles x $0.54/mile = $162. Vehicle and fuel provided by the NRCS office in Capitola, CA. Total provided by NRCS: $5,778.

Consultancy with Richard Smith and Michael Cahn of the UC Cooperative Extension of Monterey County for guide review and speaker fee for the workshops: $5,000/year x 2 years = $10,000.

d. PRIOR YEAR PROJECTS

The proposed project does not build upon any previously funded FREP projects.

Literature Cited:


