

A. Cover Page

Fertigation Education for the San Joaquin Valley Center for Irrigation Technology, CSU Fresno

1. Project Leaders

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2. In collaboration with:

USDA – National Resource Conservation Service (NRCS)

Reason for support: NRCS has special incentive programs and interest in helping small and large scale farmers implement proper technologies and applications of chemicals and fertilizers. Many small farmers in the San Joaquin valley lack access to proper technologies and education. NRCS works with them to identify and help them become more efficient and improve their proper practices. This program would further support NRCS goals and programs.

3. With Support from:

Chukou Thao – National Hmong American Farmers Association

Reason for support: Many Hmong farmers in the central valley and across the United States have recently been fined for violations. It is important for them to get proper education on applications and regulations applicable to their farming practices.

East San Joaquin Water Quality Coalition

Reason for Support: Improving fertigation and irrigation practices amongst valley growers is one essential to agriculture in the central valley. As water supply become more tenuous it is important to adopt sustainable practices to lessen nitrate leaching.

City of Fresno

Reason for Support: Groundwater contamination from historic agricultural fertilization has become a major problem. The City has wells with nitrate levels beyond drinking level standards and is costly to clean the water. A program to help alleviate this problem is essential and an important tool to resolve such this problem.

4. CDFA Funding Requested:

Funding requested from California Department of Food and Agriculture, Fertilizer Research and Education Program: \$ 49,738 (2013), \$ 49,738 (2014), \$ 49,738 (2015).

Total Cost: \$149,215

B. Executive Summary

1. Problem

The risks of fertigation are related to water (surface and ground) contaminations and human and wildlife exposure. One of the greatest risks related to water is chemical backflow into the well or source water, resulting in the contamination of ground water, ponds, canals, streams, etc. This programs purpose is avoid these issues from occurring.

Recent studies have identified fertilizers as one of the main causes in water source contamination. This is a problem that has been recognized over the last 30 years and is increasing in areas where agricultural practices are heavily active such as the San Joaquin Valley. In the San Joaquin Valley, many small farms operators are second language growers and may not know the proper application and regulation. With the continual use of fertigation system applications, thousands of growers, irrigators, irrigation dealers need to have proper access to education that allow them to understand all phases of the process of fertigation. New problems associated with these applications come to light often, and need to be addressed so that repeating these hazards can be avoided. This proposal focuses on the following topics for three years for the Fertigation Research and Education Program:

1. Injection system design, proper equipment, and maintenance
2. State rules and regulations
3. Recommended safety measures
4. Proper management methods to insure safe applications
5. Fertigation system operation and real-time demonstration display trailer

2. Project objectives, approach and evaluation

The main objective of this program is to change the fertigation practices of small and underserved farms in the San Joaquin Valley. A result of this is the alleviation of fertilizer pollution of drinking water and water sources. To do so CIT plans to educate 1,000 attendees on the proper fertigation application, best management practices and regulations. The workshops will be geared towards small farms such as the ones owned by the Hmong, Punjabi and Hispanic farmers which are typically underserved.

CIT will host 24 events over 3 years. The center will work with supporters and collaborators to schedule events. Some primary groups that will be targeted will be Hmong, Punjabi and Latino farmers. At least 18 of the events will be geared for underserved farmers. CIT will provide informational packages for attendees in their specific languages. The events will have live demonstrations and on-farm activities along with presentations.

The center will work with local NRCS to reach out to their audience and present at events. CIT will work with NRCS to identify key audiences and locations throughout the San Joaquin Valley. NRCS will assist CIT in curriculum development based on the audience.

To assure a successful program CIT will send out a post survey after six months of the event. These surveys will be utilized to see if the attendee has made changes after attending the events. The center will benchmark that at least 25% of surveyed attendees will have made some changes or plan on changing their practices after attending an event. After each event pre and post survey will be used to evaluate learning at each of the events, comments from evaluations will be used to adapt and change curriculum to assure the best learning experience.

3. Audience

The program will be geared to growers, fertilizer dealers, students, teachers, and the general public about the relationships between fertilizers, food, nutrition, and the environment. The program will have a focus on workshops in Spanish, Hmong and Punjabi for farmers.

C. Justification

1. Problem:

A recent study by the University of California at Davis about nitrogen around some of California's most intensely farmed areas has found that nitrogen from fertilizers have been a threat to and still is to drinking water sources. The study concluded that agriculture is responsible for 90% of the contamination affecting more than 250,000 people. It is believed that 1 out of 10 persons in the Central Valley are exposed to contaminated drinking water. Even if fertilizers were removed from use, it is believed that it would take more than 30 years before nitrates would not be found in wells.

The fertilizer companies have been funding research and working in conjunction with the California Department of Food and Agriculture to reduce and improve the nitrate situation on agricultural lands in California for the past 30 years. Much of the nitrates present in groundwater today have accumulated over the course of many decades, it is a problem that will be addressed by, and likely assessed on, growers today.

The report by UC Davis, lays out the problem based on a collection of existing data, and offers a number of solutions that may have direct consequences on users of nitrogen fertilizers. Furthermore it mandates that agriculture must do all it can to improve the efficient use of nitrogen fertilizers and minimize off-site movement where fertilizers are applied.

Other research by the University of California has focused on the proper amount to apply on certain crops. The proper timing and application of fertilizer especially Nitrates can help plants be more efficient in production. There are numerous researches on almonds indicating an increase in yield production with the proper application of fertilizers with upwards of 85% of the applied nitrogen being used during the season. These studies have indicated less than a 5% loss of nitrogen past the root zone.

With these findings becoming public, farmer/growers are facing several challenges: 1) justifying their practices and how they can mitigate or limit contamination. 2) How will growers address and assess these issues. 3) Possibility of regulatory change and financial responsibility of the farmers. 4) Lastly many underserved growers do not have adequate access to this information and will need to assistance to meet any new challenges.

The San Joaquin Valley has one of the largest populations of Hmong, many of whom own or operate small farms and grow specialized crops for income. Outside of the Hmong, other small farmers in the San Joaquin Valley are generally owned and operated by Spanish speaking persons, and in recent years

Sikh or Punjabi speaking farmers. These growers, although very successful face the same challenges as larger operations. Historically these groups have been underserved. These three groups tend to speak limited English and understanding regulations and rules can be a problem. With the lack of training and information many of them have been fined upwards of 36,000 dollars for violations. It is essential for these growers to learn the proper regulations and fertigation practices. These growers will be targeted especially in the San Joaquin Valley.

2. This program will meet the following FREP Goals:

CIT will focus on providing education and public information by doing the following:

- A. On-farm demonstrations of proven practices and technologies within FREP goals to encourage their adoption in California with priority areas given to impaired water bodies.
- B. Education and training of fertilizer management in areas with impaired water bodies in the San Joaquin Valley.
- C. Programs to educate growers, fertilizer dealers, students, teachers, and the general public about the relationships between fertilizers, food, nutrition, and the environment.
- D. Preparation of publications, slide sets, videotapes, conferences, field days, and other outreach activities, in English and translated to Hmong, Punjabi, and Spanish.

3. Impact

- A. Explain agronomic, economic, environmental or other implications on a local, regional, or statewide basis.

This program has the possibility of reducing backflow of fertilizers and chemicals into drinking water sources. This program will teach proper fertigation techniques and irrigation scheduling to reduce leaching into underground water sources. With proper timing and application a UC Davis study has found that over 85% of the fertilizers applied will be used throughout the growing season, limiting possible harmful contaminations.

4. Long-term solutions

- A. Indicate the projects potential for measurable progress toward long-term solutions to the specific problems addressed in the proposal.

This program has the potential to change the behavioral practice of growers in the San Joaquin valley which is one of the most highly contaminated groundwater basins. Changing the practices of growers can have a lasting effect on contamination. With fewer fertilizers being applied there will be less contaminated runoffs, leaching and backflow contamination to the water source. Demonstrating proper application at the right rate, right time and right place for the underserved growers are important because they impact the outcome of the basin and aquifer.

A major element of contamination is nitrates, which can be traced to fertilizer applications. Some approaches being suggested to assess nitrate loading to groundwater include: control and monitor nitrate application and management practices to minimize nitrogen leaching; measure soil nitrogen to guide agronomic practices and assess leaching from the root zone; and monitor nitrate and ammonium in groundwater. The best way to help growers understand these suggestions is to provide them education and information in a timely and informal way.

5. Related Research

CIT has recently completed their Irrigation Technology Workshop series. These were hands on demonstrations produced on the CSU Fresno farm laboratory, and locations across the San Joaquin Valley sponsored by the California Department of Water Resources. This program was a 12

workshop program conducted over three years and reached over 600 participants. The workshops included topics; chemigation, fertigation, energy efficiency, proper irrigation system maintenance, and new irrigation technologies. The workshops were live demonstrations that allowed participants to interact and in some cases use equipment and see them operate. Feedback has indicated that these types of workshops are much more successful in delivering information than just a classroom setting or lecture.

One of the many education programs the center operates is the Advance Pump Efficiency Program (APEP) funded by PG&E. The program began in 2002 and is still in operation today. The purpose of this program is to encourage growers to retrofit or change their pumps and equipment to more energy efficient ones. This program has incentives for growers whom participate to get partial reimbursement for pumps that qualify.

Between 2006 through 2008 the center produced 60 workshops demonstrating proper pesticide and chemigation practices. The workshops were geared toward NRCS and Department of Pesticide Regulation (DPR) staff throughout California. This program covered topics such as Best Management Practices, proper equipment management and installation, and different technologies.

CIT has also produced workshops covering topics such as Solar in agriculture and Water in Agriculture. CIT recently published the Agricultural Water Use in California report. The report is an update to a 1982 report published by Hagen & Davenport titled "*Agriculture Water Conservation in California with Emphasis on The San Joaquin Valley*". This report highlights the current findings of state agencies, University of California, and California State universities.

6. Contribution to knowledge base

This project will include but not limit recent CIT research and studies that were conducted by CIT research staff and CSU Fresno university faculty. CIT will also incorporate and cite the studies of University of California research as guidance for growers whom participate. When possible, specific information that will be given to attendees will include UC studies on crop nutrient requirements and nitrate contamination studies. When applicable regulatory and best management practices handouts will be given out.

NRCS programs will be highlighted at the events to promote proper fertigation practices. CIT will also cite NRCS incentives and programs that will be beneficial for growers. Some examples of programs that will be mentioned will be the Agricultural Water Enhancement Program (AWEP), which is a voluntary program that provides financial and technical assistance to producers to enhance activities on agricultural land.

CIT has worked on numerous studies involving irrigation technology, chemigation practices, fertigation practices, management practices, and crops such as pomegranates, almonds, tomatoes and corn and will utilize these research projects whenever applicable. The findings of these studies can be made public and used by growers to further enhance their farming practices.

Many of the events will be videoed taped and the recordings will be available for viewing at CIT website. The videos produced by this program can be used as tutorial or educational tools for growers.

CIT has developed many manuals and outreach materials in the past. CIT staff has been involved with the development of the Irrigation Drainage Manual. CIT staff has also been involved with the development of development of Best Management practices for Application of Food Processing By-products on Farmlands. See appendix for links to the manuals.

7. Grower use

NRCS has incentive programs for small farms that they can apply for helping them change their farming practices and installing more modern and efficient technologies, especially chemical injection equipment for fertilizers and pesticides delivered through the irrigation system.

Another incentive is that these events can help the growers avoid costly fines for violations that they may not have known about or could have avoided with the proper equipment. These workshops can help growers understand how to properly maintain their equipment and how to use them effectively and efficiently.

According to research, California farmers applied 740,000 tons of nitrogen in fertilizers in 2007 alone, of this only 50 percent of it is used by the crops. This is an indication that growers are not effectively applying their fertilizers at the right time and/or rate. This study suggests that half of the fertilizer applied goes to waste. The remaining half fertilizer dissolve and move into the ground below and may leach into groundwater beneath. With more and more underserved growers becoming prevalent in the industry it is essential to provide them with the best information for a successful future.

D. Objectives

The primary objective of this program is to reduce fertigation pollution of drinking water by farmers. To do so we need to change the cultural practices of the growers. A secondary objective is to educate the underserved Hmong, Punjabi and Latino speaking famers/growers about state rules, regulations, proper management and design so as not to contribute to the problem of farmers contaminating drinking water sources. The CIT goal is that 75% or more of the attendees learn or gain some knowledge about proper fertigation practices and irrigation scheduling to minimize leaching and at least 25% of them will implement changes on their farms as a result of attending the workshops.

To do so, CIT will educate at least 1,000 attendees on the best management practices, rules and regulations and plant intake and uptake regimes based on research throughout the 24 workshops.

E. Work plan & Methods

1. Work Plan

Major Tasks

Task 1: Project Management

CIT will conduct administration and management tasks during project implementation. Administration and management services include providing departmental support and specialized facilities associated with this project. The project coordinators will work with different staff to organize and publicize events to the general public.

Task 2: Education Advisory Board

CIT will develop and seek an advisory committee to assist in the development of the educational program on efficient fertigation practices, new technologies, and best management practices. Committee will include members with agricultural irrigation system design expertise, farm operation practices, state regulatory issues and fertilizer applications. CIT will work with industry professionals and identify innovative methodologies to conduct live demonstrations and hands on teaching. CIT will work with the Fresno State staff and faculty and has many staff members with such expertise already on hand. NRCS staff will be utilized in advisory board and will be asked to present at different events and add their expertise and program cost sharing as a benefit to attending growers. NRCS staff will provide translation services in Hmong, Punjabi and Spanish at events.

The advisory committee will include the following:

NRCS - Sam Vang, Rob Roy
CIT Staff – William Green & Kaomine Vang
Fertilizer Sales Representative- Dave Marlor
Certified Crop advisor – Wayne Stegobawer
Drinking Water Quality – Sarge Green/Dr. Karl Longley (California Water Institute)
Land Nutrient Management – Sajeemas (Mint) Pasakdee, Ph.D., (CIT)

Task 3: Curriculum Development

CIT will develop and seek advisory board recommendations on the best methods to increase grower acceptance of fertigation and irrigation practices within the San Joaquin Valley. CIT will conduct workshops including, but not limited to material developed by the industry and professionals. The workshops will be 3-4 hours long and will focus on different fertigation topics. **The curriculum will focus on fertigation practices, drinking water quality, nutrient use and efficiency, nutrient management for crops grown by the local growers and irrigation scheduling to place fertilizer in the root zone and reduce leaching pass the root zone.** CIT will work with different marketing orders to best identify issues that relate to their groups. The Center will work with different organizations such as NRCS identify topics of concerns. Workshops will be focused and offered throughout San Joaquin Valley. Some workshops will be focused on regulation and Best Management Practices (BMPs). Other will be on-farm hands on demonstration at local farms or at the CSU Fresno Farm laboratory. CIT has several Mobile Education Centers (MEC) that they have utilize to present at different events throughout the state. The MECs are towable trailers and have upwards of \$50,000 worth of irrigation, chemigation and fertigation equipment installed and is readily available. Very little equipment would have to be purchased because CIT already has it in place. The Hmong, Punjabi and Spanish speaking growers will be heavily targeted and will have separate workshops that will be translated to their language including handouts and materials to assist them in improving fertigation and irrigation practices to limit leaching of fertilizers.

CIT will work with NRCS to arrange at least 1 event per group (Hmong, Punjabi, Spanish) per year. CIT plans to present at the annual National Hmong American

Farmers Association (NHAFA) Conference held every summer in Fresno, Ca. CIT will work with the NHAFA to encompass and distribute its research and findings to them.

At events targeted towards specific groups (Hmong, Punjabi, Spanish) CIT will work with NRCS to have translators available to these groups. NRCS has years of experience working with underserved farmers and has agreed to cooperate and have their translators readily available.

CIT will invite and encourage CDFA consultations when establishing curriculum for particular workshops. The curriculum will be sent out in advance to CDFA for comments prior to publishing.

Task 4: Outreach

A total of 24 workshops will be conducted over 3 years. CIT will utilize website, mailing list, social media and public forums to reach out to the public. The center will work with NRCS to reach their constituents and will utilize local Hmong and Punjabi radio broadcasts to reach the target audience. CIT will also work with collaborators and supporters to announce events and disseminate research and practices. Videos of various events will be recorded and posted to the CIT website. Any material (pamphlets, power points, videos, recordings, etc.) developed during the program will be available online at the CIT website.

Outreach material such as mailers, emails and public announcements will be sent out several weeks prior to events. The materials will be sent to collaborators and supporters to disseminate amongst their constituents. CIT will make public announcements in local farming news and media outlets. CIT will also send emails to its partners and other regional organizations. The center will work with its collaborators to announce events on public calendars and radio outlets when possible.

Task 5: Program Monitoring

CIT will survey program participants for feedback on modifying educational materials for future outreach efforts. CIT will track the number of attendees whom participate in the workshops. The attendees will be asked to fill out follow up surveys after they attend the workshop event. These surveys will be used to determine if any on-farm changes have taken place after they attend the event.

Task 6: Evaluation

There will be three separate methods of evaluation for these workshops.

- 1. A pre and post questionnaire with 5 questions pertaining to the curriculum to be presented at that day's workshop will be handed out to all attendees. They will answer the 5 questions prior to the workshop commencing and at the conclusion of the specific workshop to gauge curriculum effectiveness and increased knowledge of the attendees. A percentage increase will be documented and recorded for each workshop.**
- 2. An evaluation will be distributed and collected for each individual attendee at every workshop measuring the overall experience, curriculum materials and comments regarding the materials presented and suggestions for future workshop topics and ideas. I.e. evaluations from attendees will be asked to gauge from Strongly agree with**

content to Strongly disagree with content presented at the workshop. An average for each of the questions will be measured and posted in the quarterly, annual reports and program database.

3. 6 months after each individual workshop event, an email questionnaire will be conducted to measure changes in behavior, equipment, and on farm improvements that workshop attendees made or plan to make due to their attendance at the workshops. There will be 3- 5 questions on each survey only resulting in data points for effectiveness of workshops attended.

Surveys will be sent out six months after each event. The surveys will be used to measure changes in behavior, equipment, and on farm improvements. The survey will identify the percentage of the participants who have made changes or plan to make changes due to their attendance of the event. Pre and post workshop event survey questionnaires will be given at the start and collected and the end of each workshop and used to identify increase of knowledge of participants during the actual workshop. These percentage increases in knowledge will be recorded. Also, at the end of each event, evaluations of workshop performance will be collected along with comments from the event will be taken to garner feedback on overall experience, curriculum material and recommendations for changes or topics.

Task 7: Reports

There will be 3 interim reports 2 annual reports and 1 final report. The interim reports will cover the first six months of every project year (January to June) project. Interim reports will not exceed 3 pages and will include charts, tables, names, address and phone numbers of project leaders, project title and grant number, a brief narrative regarding project activities, completed tasks, and will contain project progress, difficulties, and plans for the next work period. The 2 annual reports will be less than 5 pages. It will include a brief summary that will cover 12 months of the project. Annual reports will summarize the activities and information and will include products produced throughout that year and attendee counts. The final report will be in the same format as the annual reports but will include all data, results, and discussions throughout the project.

2. Schedule

Task No.	2013	2014	2015	2016
	J F M A M J J A S O N D	// J F M A M J J A S O N D	// J F M A M J J A S O N D	
1	s-----			c-----
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5	s-----			c-----
6		s-----		c-----
7	-----I-----	-----A-----	-----I-----	-----A-----I-----F
S: Start c: Complete I: Interim Report A: Annual Report F: Final Report				

3. Methods

- A. Explain the methods to be employed, indicating data to be gathered, parameters to be measured and methods of analysis to be used, including sampling scheme and experimental design, if applicable.

CIT will have 24 workshops on-farm demonstrations of proven practices and technologies within FREP goals to encourage their adoption in California. CIT will post all publications, slide sets, videotapes, conferences, field days, and other outreach activities on their website for public access. The 24 workshops of 3 hour to 4 hours in length for growers, irrigators, irrigation dealers, and regulatory staff as requested by California Agricultural Commissioners- CAC, Resource Conservation Districts- RCD, the NRCS, and/or Irrigation dealers, etc. These workshops will include, a real-time display of fertigation and additional lecture involving fertigation topics from groundwater to field application techniques, proper irrigation scheduling and other issues. The curriculum will be designed to enhance safe fertigation practices and water source protection. On farm demonstrations and workshops will be utilize whenever possible to get the “learn by doing” experience.

The USDA/ NRCS in Fresno, CA, in collaboration with the Center for Irrigation Technology (CIT) at California State University, Fresno will offer at least 4 distinct Backflow Prevention/ Water Source Protection from Fertilizer Contamination workshops targeting historically underserved farmers and farmworkers in the San Joaquin Valley. Specifically, these groups include SE Asian, primarily Hmong speaking, Sikh or growers from India, primarily Punjabi speaking, Hispanic growers, primarily Spanish speaking, and the 4th for English speaking attendees. The workshops specifically target each group individually so that translation of written materials and lectures with equipment demonstrations will focus on each group separately. A total of three workshops for each group will be offered twice per year. This will total 18 workshops in Hmong, Punjabi, and Spanish over the three year proposal cycle with an additional 6 workshops offered in English during the contract duration. The workshops locations will concentrate on individual group population centers so that a maximum number of farmers can easily attend.

F. Project Management, Evaluation and Outreach

1. Management

CIT will be the lead agency on the project. Project leaders will organize, plan, and setup outreach programs. Project leaders will contact cooperators and setup events at various locations throughout San Joaquin Valley. CIT will work with cooperators for outreach. The Cooperators will contact their constituents and help with the marketing and outreach. CIT will adjust the curriculum according to the audience. Some specialized tools and presenters will be used according to the audience practices.

William Green and Kaomine Vang have a combined experience of over 25 years producing workshops and has traveled throughout the state speaking about different grower topics. Bill is currently the Educational Specialist for the Advance Pump Efficiency Program which is focused with energy efficiency and savings. Kaomine Vang has worked with disadvantage communities on drinking water related issues such as nitrate and coliform contamination in the San Joaquin Valley. He is also the lead program manager for the WATERIGHT for Kids program which emphasizes water conservation science education for kids. Bill Green and Kaomine Vang have produced over 30 workshops and seminars together within the last 3 years. Many of the workshops involved different irrigation technologies, irrigation methodologies, farming practices, water technology, and solar technologies.

CIT's combined staff has produced more than 300 workshops, seminars, and conferences in the last 10 years. They have produced events covering topics such as new regulatory demands, pesticide practices, fertigation practices, water management and irrigation scheduling, water technology, energy technology, agricultural laws and policy changes. They have worked with different government agencies such as the USDA, Water Board, Department of Water Resources, and The Department of Fish and Game.

CIT will work with the National Hmong American Farmers (NHAF) to promote events with the Hmong farmers in the San Joaquin Valley. CIT will present at NHAF events and promote proper technologies and practices. The center will work with NHAF to disseminate information amongst its core audience.

The NRCS involvement will include advertise these events along with contacting historically underserved group leaders within their database to help promote attendance and offer excellent locations for field demonstrations. The NRCS will also promote and explain irrigation system cost sharing programs they sponsor to help install backflow prevention devices and properly apply fertilizers through the irrigation system via Fertigation. Additionally, handouts and materials will promote the safe use of chemicals including pesticides and fertilizers to educate growers regarding Nitrate leaching, and potentially other unsafe practices when applying chemicals to their farms. The NRCS personnel will attend the workshops, help gain attendance in the specific groups, assist with curriculum and presentations focused on Water Source Protection and Best Management Practices for Disadvantage and Historically Underserved farmers, and assist with translation services.

CIT will conduct the workshops utilizing existing demonstration equipment, supply handouts and materials translated specifically to the target group at each workshop, and manage the workshop program overall including expenses, locations, and travel. CIT will make all final arrangements, set up equipment, advertise the workshops through normal media channels, and record RSVP's and actual attendance to the events.

CIT has targeted and worked with underserved groups before below is a list of events we have produced in the past.

1. Feb 9, 2012- San Benito County Water District hosted a Chemigation workshop. We designed and presented curriculum and gave a live equipment demonstration of proper chemigation techniques, application, and safety that was translated to approximately 10 farm workers simultaneous to the 40 farm managers and owners.
2. Jan 19, 2012- San Benito County Water District hosted and Advanced Pumping Efficiency Program energy efficiency and water workshop for 45 growers and their laborers that was translated to Spanish. Workshop curriculum included pump energy efficiency, proper flow and pressure, live demonstration of pump equipment, and workshop handouts translated into Spanish.
3. April 7, 2011- Approximate 20 farmworkers joined 30 farmers at a workshop on pump efficiency and chemigation hosted by the Central Coast Waterboard and CIT that featured translation in to Spanish during the lecture and equipment demonstration.

4. Dec 11, 2007- SCE AGTAC in Tulare and CIT co- hosted a Spanish translation workshop at their facility in Tulare. CIT presented lecture and equipment demonstration to approximately 23 attendees, most of which did not speak English as a first language.
5. Nov 29, 2005- CIT partnered with ALBA (Ag Land Based Assoc.) in Salinas, CA to host 2 workshops in one day presented to 35 non English speaking attendees. The event was translated into Spanish on pumps and irrigation subjects.

2. Evaluation

1. Pre- and Post-workshop questionnaires will be utilized to measure participant advances in knowledge at each event. At the beginning of each event surveys will be given to track current knowledge. Towards the end of each event the attendees will take the same survey to see if they have increased their knowledge of the particular topic.

The pre and post workshop survey will consist of 5 questions regarding proper fertigation and fertilizer practices. The attendees will answer Yes- they have knowledge of the proper practice or equipment, or No- they don't have knowledge of the proper practice or equipment for each question prior to the workshop. At the end of the workshop, the same 5 questions will be posed, and the attendees will again answer Yes- they have knowledge of the proper practice, or No- they don't have knowledge of the proper practice. If the workshop is successful, at least 75% of the respondents will have gained some knowledge from the workshop curriculum. The Center has utilized this method in its energy efficiency workshops and have found them to be quite representative of knowledge gained at the event

2. Attendees will be required to fill out a workshop evaluation to provide feedback to track workshop effectiveness.

Any concerns or critiques about an event can be addressed and modifications can be made before the next workshop. Curriculum, lectures and demonstrations will be revised and tailored to pertinent specialty crop information for each event. The post workshop evaluation will use a Likert-type scale from 1 to 5, 1 being the worst score, and 5 the best. For the evaluation, an average cumulative score of 4.0 or better is considered successful.

3. A follow-up survey will be conducted six months after each workshop to assess any on-farm changes that may have been implemented or planned on due to the workshop. The benchmark for the six month follow-surveys is to get a 25% of the returned surveyors implementing changes to practices or equipment for fertilization and fertigation.

4. Outreach

Through its current programs CIT has a plethora of partners in local agencies, organization, specialty groups, and vendors. The center will contact these groups and work with them to promote their events to their audiences. CIT will organize and promote special grower meetings and will present to farmers, applicators and crop advisors. Free radio ads with local radio stations will be utilize to reach different underserved groups. Hmong, Punjabi, and Spanish radio shows

will be utilized to reach out their constituents. When appropriate a project leader may be available to a radio show or television show for interviews and demonstrations.

The National Hmong American Farmers Association (NHAFA) has yearly conferences, which CIT will present and demonstrate. CIT will work with the NHAFA to promote proper and efficient fertigation practices.

CIT will work with NRCS local agencies to promote field days with their local core farmers. The center will work with NRCS agencies to promote technologies, programs and proper techniques. NRCS will contact and work with their core groups to promote events at their site locations. NRCS has contacts at local radio stations and has a vast database of under-served farmers and growers CIT will use this database to contact the growers.

Field days will be conducted at various locations. On campus demonstrations will be on the California State University, Fresno Farm Laboratory. Off-site locations will utilize CIT's Mobile Education Centers (The MEC's are towable trailers with fertigation, chemigation and irrigation equipment installed for live interactive demonstration purposes). CIT will work with NRCS to promote activities amongst their constituents and will use MECs at their preference.

Project leaders/cooperators will conduct grower field days, or other outreach activities at the request of the FREP staff. If such an activity is carried out, it will be credited towards fulfilling the outreach requirements of the grant.

Project leader's will be attend and present the projects progress and findings at a minimum of one annual FREP conference.

Appendix

Manual of Best Practices for Application of Food Processing By-Products on Farmlands
(<http://cati.csufresno.edu/update/PDF/Update-2011-Spring.pdf>).

Integrated On-farm Drainage Management: Using Plant Transpiration to Reduce Drainage Volumes
http://cit.cati.csufresno.edu/research_publications/99/990602/index.html

Backflow Prevention and Safety Devices for Chemigation
http://cit.cati.csufresno.edu/research_publications/98/981201/index.html

Irrigation Technology Education Series
<http://www.californiawater.org/IrrigationTech/>

Advance Pump Efficiency Program Material
<http://www.pumpefficiency.org/About/literature.asp>

Other CIT Research & Publications
http://cit.cati.csufresno.edu/research_publications/

References:

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