Project Title: Improving Fertilizer Practices of SE Asians in Fresno and Tulare Counties

CDFA Contract: 96-0405

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Objectives:

1. To obtain background and demographic information of Hmong, Mien, and Lao farmers through a survey, and ascertain current fertilizer practices, as well as knowledge of plant nutrition and fertilizer use through a "pretest".

2. To provide seven training classes, demonstrations, and/or workshops in the areas of plant nutrition, fertilizer analysis, integrated pest management, and chemical safety.

3. To statistically measure the effect (if any) of gained knowledge in plant nutrition through a posttest, at the conclusion of the training sessions.

Executive Summary:

A project was implemented to measure what effect (if any) a series of seven training sessions would have on learning and knowledge in the areas of plant nutrition, fertilizers, integrated pest management (IPM), and chemical safety with SE Asian vegetable farmers in the Central San Joaquin Valley. Previous work has shown that the majority of SE Asian vegetable farmers are of Hmong (62%) and Lao (30%) decent. Mien, Chinese, Cambodian, Japanese each contribute 2% or less to the total. The Hmong, Lao, and Mien are political refugees from Laos and started immigrating to the US in 1978-9 after the Vietnam war ended. Each group has a separate language and culture. The largest single concentration of Hmong in the US are located in Fresno County. An assessment of their fertilizer practices revealed that 15-15-15 granular fertilizer was the most common complete fertilizer, and UAN 32 and CAN 17 were the most common nitrogen sources. The granular triple 15 is often applied after crop emergence and on top of the bed surface.

Socio-demographic information from the grower survey **(task 1)** of 32 SE Asian farmers showed the majority of the respondents to be Hmong farmers from Laos. All participants were male. When asked about formal education, less than 22% had finished 8th grade. Farming practices

d) WORK DESCRIPTION: Introduction

Fresno and Tulare Counties are first and third in the state for agricultural production, total value. There are more small farms and SE Asian vegetable farmers in these two counties than the other 56 counties in California. A *small farm* is one that is 'family run' and grosses less than $250,000 in sales. Immigrants from Laos comprise the majority of SE Asian small farmers and estimates are in the range of 800-1,000 immigrant farmers. Hmong, Lao, and Mien emigrated to the US from Laos in 1978, after the Vietnam war, primarily to escape reprisal from the Communist government in that country. Hmong make up about 62% of all the Asian farmers, and 30% are Lao. New groups of immigrants from Laos continued to come over until 1998 when the refugee camps in Thailand were closed. The majority settled in the Central San Joaquin Valley, and specifically Fresno County.

Each of the three main groups has their own separate language, very limited education, and are not familiar with modern technological farming in the Western World. The type of farming in Laos was "slash and burn", and almost no mechanization. The majority of Strawberries in Fresno and Tulare are raised by the Hmong, Lao, and Mien, as well as many other Asian specialty crops such bittermelon, opo, sinqua, moqua, doan gwa, daikon, bok choy, lemongrass, etc. It is estimated that between 25,000-35,000 acres are farmed intensively by these groups.

Current Fertilizer Practices

Task 1. The most commonly used fertilizer with almost all growers was 15-15-15, a granular complete fertilizer. Several growers had equipment to broadcast the fertilizer prior to planting and bed formation, however, the majority of growers apply the fertilizer after the crop emerges, over the top of the bed by hand. Rates varied between 2-4 sacks per acre (50 pound each). Sometimes the fertilizer is moved into the soil with rain, but often the fertilizer is dissolved with the ditch water during irrigations. This was also the case with the strawberry growers who tend to be somewhat more knowledgeable and have access to drip irrigation. One grower, in fact, routinely dissolves the triple 15 fertilizer in a 55-gallon drum and mixes additional nitrogen with UAN 32. Since not all of the fertilizer dissolves the first time, water and UAN 32 are again added to the drum and used in another section of strawberries. UAN 32 and CAN 17 are the other two commonly used fertilizers. There is not a clear understanding of fertilizer analysis, thus the two liquid fertilizers are used interchangeably at about the same rates, even though one contains almost twice the 'N' content. Rates of UAN 32 and CAN 17 are usually measured in buckets (5 gallon), with the average application being 2-3 buckets per acre, 30-45 lbs. 'N' per acre. Rarely are soil tests ever taken to determine nutritional levels, and it would appear that most farmers we surveyed were under-fertilizing with nitrogen.

Task 1.1 and 1.2. Survey and Pretest

Twenty Hmong/Lao/Mien farmers were identified to participate in the project and were asked to complete a survey of socio-demographic and farm characteristics, as well as knowledge prior to the beginning of the sessions. Since language is a major obstacle for many of the farmers a Hmong assistant was employed to provide translation. The survey and pretest were given in the field, each one lasting for approximately 2 hours. The growers had many questions when it came time for the pretest, and wanted to know the correct answers after they had given their answers.

were also queried and it was learned that 60% have been farming for less than 4 years in the United States, and have little exposure to Western technology. Average age of the respondents was between 41-45 years old. The participants raised a variety of crops, including green beans, strawberries, cherry tomatoes, and specialty Asian vegetables. Farms are on rented land by 97% of the farmers, and 97% farm 20 acres or less. The most commonly reported injury/illness was back injury, followed by dizziness. It was also quite apparent that this group was much more concerned about chemicals and pesticides than other types of farm-related injuries.

A series of seven training sessions **(task 2)** were presented by the University of California farm advisor in Fresno County and translated by a Hmong assistant. Each session lasted 3 hours during the evening, one day a week, and included topics on plant nutrition, chemical safety, fertilizer analysis, integrated pest management, specific crop nutrient needs, and plant pest problems. An initial pretest was given to determine the group's knowledge and level of understanding in plant nutrition. The questions were designed to find out if growers possessed a basic understanding of nitrogen, phosphorous, potassium fertilization, plant needs, deficiency symptoms, fertilizer placement, and fertilizer analysis. The scores indicate that the group's level of understanding about plant nutrition was quite low. The average number correct out of 8 questions was 1.9.

On the final training session, a posttest **(task 3)** was given to determine what impact the workshops had on learning and retention of the group. The scores were significantly improved (5 correct) indicating that the seven workshops did improve the growers understanding about plant nutrition ($p<.05$). A similar improvement was also observed with questions related to integrated pest management.

Having significantly improved posttest scores after seven training sessions is encouraging considering the fact that the participants have a number of challenges to overcome, including language, a short time in the US, a new culture, and very little exposure to new technology. The study also points out that training is a long term and on-going process, and having someone to translate into their language is critical. Having other incentives such as continuing education hours, certificates, and educational materials such as gloves/goggles and hand lenses improved attendance over our first initial attempts. The participants proposed fewer days and longer training hours for future workshops.

The initial plan was to conduct the training sessions in the farmer's field where a group of up to 6 farmers would come for the trainings. Half way through the interviews it was realized that his method was not practical because the farmers would not always be in their field, they might be in another location, they did not always keep appointments, and farmers were hard to get a hold of. It appeared we would have to conduct individual training sessions for each participant, which was not efficient, nor practical.

The plan was then revised to bring the group together in one meeting place for 7 training sessions during the evenings, one day a week. Various incentives were offered such as DPR (Department of Pesticide Regulation) approved continuing education for their permits, certificates of completion, and complimentary training materials such as insect charts, hand lenses, gloves, goggles, and other personal protective equipment (PPE). Some of the initial group did not attend so new participants were recruited.

Task 2 Training Sessions
Following the initial survey, seven training sessions were given, each lasting three hours, from 6:00-9:00 in the evening. The Fresno County Farm Advisor provided the technical training and a Hmong assistant provided language translation. The participants had to attend at least 5 of the 7 training sessions to receive a certificate. Prizes were given to encourage them to be prompt. Various training materials were utilized including a "Best Management Practices" binder developed about 10 years ago, and other University publication materials. Outlines of plant nutrition and chemical safety training materials are included in the attachment section at the end of this report.

Task 2.1 Training Session Topics
The training topics consisted of plant nutrition, fertilizer analysis, fertilizer placement, crop nutritional needs, integrated pest management, pest identification, and chemical safety. The mix of plant nutrition, fertilizers, chemical safety, and IPM was needed to provide a variety of topics and keep them interested. It was also determined that providing smaller portions of several topics did not 'overload' the participants with information (as was described by one participant).

Task 3.1 Posttest
At the completion of the training sessions a posttest was given to measure knowledge changes as a result of the training sessions. The same test questions used for the pretest were given again to the participants. The data was analyzed for any differences in test scores as a result of the training sessions.

e) RESULTS and CONCLUSIONS

FIRST GROUP: In the first phase of the project 20 farmers were identified and given the initial survey and pretest. The goal was to conduct the entire project in field groups at their sites. Each of the twenty surveys required about 2 hours to complete because of the translation and questions from the growers. It was quickly realized that we were going to have a very difficult time getting the growers to meet at specific times for their training. They would either not show or not be able to meet at the pre-determined times. The schedule was impossible for us to know or plan for.

SECOND GROUP: An alternate plan was devised to recruit growers and bring them together in one group for one day a week. The sessions would continue for seven weeks in the Cooperative Extension office in Fresno. Each session lasted for three hours in the evening. We added incentives consisting of complimentary personal protective equipment (PPE), door prizes, and continuing education (CE) hours for their restricted permit renewal (required by the Department of Pesticide Regulation). While we did not have 100% attendance, we did consistently have 15-17 people attend all seven sessions.

Survey Results - Demographic

Farmer Background: Surveys were combined from the first and second groups for the demographic and background information (32 respondents). From table 1 we see that most of the people in the class were Hmong farmers from Laos. In the country of Laos, the mountain people are referred to as Hmong, people from the middle elevations are called Mien, and people from the low lands of Laos are called Lao. All participants were males (typical patriarchal family from a Third World country), and most were between 31 - 50 years of age. Also interesting is that almost 19% of the sample had less than 3 years of any type of formal education and 78% did not make it past the 8th grade. The refugee camps in Thailand were closed in 1998, but until that time refugees had continually been brought over to the United States, which is consistent with the number of years in the U.S. as reported by the respondents.

TABLE 1. RESPONDENT CHARACTERISTICS

RESPONDENT CHARACTERISTICS	*Number*
ETHNICITY	
Hmong	29
Laotian	2
Cambodian	1
COUNTRY OF ORIGIN	
Laos	30
Thailand	1
Cambodia	1
NUMBER OF YEARS IN THE U.S.	
4 to 8 years	3
9 to 12 years	2
13 to 16 years	7
17 to 19 years	14
20 to 25 years	6
AGE	
31 years to 35 years	6
36 years to 40 years	6
41 years to 45 years	5
46 years to 50 years	7
51 years to 55 years	5
Over 55 years	1
(two missing cases)	
SEX OF RESPONDENT	
Male	32
Female	0
EDUCATION	
Less than 3 years	6
3 to 4 years	9
5 to 6 years	7
7 to 8 years	3
9 to 10 years	3
11 years or more	4

Farm Characteristics: When asked how many years they had been farming in the U.S., 60% reported 4 years or less (table 2). This finding is important because it suggests they have had limited exposure to Western technology. Also interesting is the fact that 97% farm less than 20 acres. Only one person had more than 20 acres, and almost everyone rented their land. When

asked about the crops they raise the main crops were green beans and strawberries, and the most often used place to sell their produce was the local packinghouse (41%), even though a 10% commission is taken from their sales. Only 25% of the farmers sold at a farmers market, most likely because either they do not understand this method of marketing or they do not have the time to spend at farmers markets.

TABLE 2. FARM CHARACTERISTICS

CHARACTERISTICS	*Number*
YEARS FARMING IN U.S.	
None	2
1 to 2 years	6
3 to 4 years	10
5 to 6 years	6
7 to 8 years	2
9 years or more	4
(2 missing cases)	
TOTAL NUMBER OF ACRES	
1 acre or less	7
2 acres	11
3 to 4 acres	2
5 to 9 acres	2
10 to 12 acres	4
13 to 15 acres	1
16 to 20 acres	4
More than 20 acres	1
RENT OR OWN ACRES	
Rent	30
Own	2
MAIN CROP	
Beans	13
Strawberries	7
Tomato	2
Moqua	2
Eggplant	2
Lemon grass	2
Other	3
none grown	*1*
MARKET OUTLET	
Farmer's Market	8
Packing House	13
Farm/Packing House	5
Roadside Stand	0

Pests and Chemicals: A variety of insects and weeds were mentioned (table 3) as problems on their farm, however as was seen in the pretest, most of them have difficulty identifying the various pests by name. A variety of insecticides were mentioned, however only two herbicides were used by this group - Roundup® and Gramoxone®. None of the group reported using preemergent herbicides, probably due to the complexity of rates, calibration, and lack of appropriate incorporation techniques.

TABLE 3. MOST FREQUENTLY MENTIONED PEST PROBLEMS (Open-ended response)

PEST PROBLEMS		*Number*
INSECT OR DISEASE		
	Spider mites/Mites	9
	Aphids	7
	Worms	7
Whitefly		3
	Other	8
WEEDS		
	Johnson grass	5
	General grasses	8
	Pigweed	4
	Lambsquarter	4
	Nutsedge	4
	Bindweed	2
	Other	2
	General weeds	9

CHEMICALS USED		*Number*
INSECTICIDES		
	Dipel	11
	Lannate	8
	Asana	5
	Diazinon	2
	Malathion	2
	Other	2
HERBICIDES		
	Roundup	18
	Gramoxone	2
	Other	4

Technical Assistance: The most often used resources for information are nurseries (referring to strawberry plant nurseries and strawberry contract processors), UC Cooperative Extension, and the county agricultural commissioners office (table 4).

TABLE 4. TECHNICAL ASSISTANCE

TECHNICAL ASSISTANCE	*Number*
SOURCES OF INFORMATION	
Nursery	8
UCCE Farm Advisor	7
Ag. Commissioner	5
UC Small Farm Center	1
Friend	1
No sources reported	*7*

Chemical and Pesticide Safety

Survey questions were asked to determine what the most important chemical and pesticide safety issues were, the types of symptoms experienced by farmers, and what personal protective equipment (PPE) was used. As seen in the tables below, backpain was the most common complaint, and dizziness the second most common. The participants pointed out that it is difficult to separate cold or flu symptoms from farm injuries and illnesses. Participants were much more concerned about issues related to chemical fertilizers and pesticides than they were about farm injuries and possible sun cancer (Table 7).

TABLE 5. SYMPTOMS RELATED TO ILLNESS AND INJURY: EXPERIENCED WITHIN THE PAST FIVE YEARS

SYMPTOMS	*Number*
Skin rashes	1
Burning in throat or lungs	0
Back pain	13
Nausea	4
Vomiting	0
Dizziness	7
Cuts from tools	4
Eye pain	2
Blurred vision	1
Injury from tractor	1

TABLE 6. PROTECTIVE ACTION TAKEN WHEN APPLYING CHEMICALS

PROTECTIVE ACTION	*Likely to take action*
Coverall Suit	7
Mask/Respirator	9
Gloves	12
Goggles	9
Boots	12

TABLE 7. CONCERN FOR HEALTH AND SAFETY RISK AREAS RELATED TO FARMING

RISK AREA	*Very Concerned*
Inhaling farm chemicals	25
Spilling chemicals on you	29
Splashing chemicals in eyes	28
Storage of chemicals	26
Exposure to children and pets	26
Skin cancer from sun	15
Injury from tractors	13
Cuts from handling tools	14

(Missing cases: 1)

Results - Training, Pretest, Posttest; The results of the training sessions, and their effect on learning, retention and improved test scores are discussed below.

Discussion of Overall Test Scores -- * includes both Plant Nutrition and IPM

In order to statistically measure the effect of gained knowledge in plant nutrition due to the training sessions, a 18 item knowledge test was administered before the first workshop (pretest), and the same test was administered at the conclusion of the last workshop (posttest) (See

Appendix). Furthermore a pretest was obtained from an additional group of growers who participated in the general survey, but not the workshops. Mean test scores were calculated and t-tests were used to measure the statistical significance for any changes in mean test scores (Table 8-9). In several cases among the workshop participants only a pretest or a posttest was obtained. Overall, both a pre- and a posttest were obtained from 9 of the 19 participants. The Hmong field assistant was available to provide translation of the test when it was administered.

The average pretest score among all those who took the pretest was 3.93 out of 18 (Table 8, group I). Overall, the highest pretest score was 11 out of 19; the lowest score was 1. Among those who participated in the training sessions and took both the pre and posttest, the average score was slightly higher than those who did not participate in the training, 5.44 versus 3.25. A t-test was used to determine if there was a statistically significant difference between the mean pretest scores among those who did not attend the training versus those who did. Even though those who attended had a slightly higher mean pretest scores compared to those who did not attend, the difference was not statistically significant ($p => .10$) (Table 9). This finding suggests that the growers who attended the training sessions were not more knowledgeable than the larger sample of growers who participated in the general survey.

The average posttest score among all those who took the posttest was 9.47 out of 18 (Table 8, group II). Among those who participated in the training and took both the pre and posttest, the average posttest score was higher than for those who took the posttest only, 10.89 versus 7.87. The highest posttest score was15 out of 19; the lowest score was 2. A five-point improvement was the average change in the scores among the nine who took both the pre and posttest. In one case, the grower scored one point less on the posttest than the pretest; in another case the grower maintained the same score; otherwise, growers showed an improvement in their knowledge as a result of the training sessions.

In order to determine whether the difference in mean pre versus posttest scores was statistically significant versus due to chance, a student's t-test was used. When all pretest scores were compared to all posttest scores, the increase in mean test scores was statistically significant at the .001 level (Table 9). Among the nine who took both the pretest and the posttest, the increase in test scores were statistically significant at the .05 level. Both of these results suggest that the training sessions were successful in increasing the growers' level of knowledge on plant nutrition and IPM, and that the changes in mean test scores were not due to chance.

Finally, in order to assess whether taking the pretest helped to improve the participant scores on the posttest, a t-test was calculated for mean scores for those who took both the pre-and posttest versus those took the posttest only. The difference in mean scores was not statistically significant ($p = >.10$). This finding suggests that the knowledge increase revealed in the improved test scores at the conclusion of the training sessions is due to the sessions, not due to learning that occurred from taking the pretest.

TABLE 8. ASSESSMENT OF PRE- AND POSTTEST SCORES: Univariate Statistics

Groups	*N*	*Mean Score*	*Standard Deviation*	*Minimum Score*	*Maximum Score*

I.	ALL PRETEST	29	3.93	3.210	1	11
a.	Pre/post Test	9	5.44	3.909	1	11
b.	Pretest Only	20	3.25	2.670	1	11
II.	ALL POSTTEST	17	9.47	3.910	2	15
a.	Pre/post Test	9	10.89	2.370	8	15
b.	Posttest Only	8	7.87	4.794	2	15
II.a.-I.a	Change in Scores Before vs. After Workshop for Pre/Post Test Group	9	5.44	1.650	-1	13

TABLE 9. ASSESSMENT OF PRE- AND POSTTEST SCORES: Statistical Significance

Groups	*Comparisons*	*T-Test*	*DF*	*Prob.*	*Significance*
I. vs II.	All Pretest vs. All Posttest	5.21	44	<0.0001	****
I.a. vs II.a.	Pre/post Pretest vs. Pre/post Posttest	3.30	7	0.0109	**
I.a. vs I.b.	Pretest Only vs. Pre/post Pretest	1.77	27	0.0880	*
II.a. vs II.b.	Posttest Only vs Pre/post Posttest	1.67	15	0.1147	--

Level of Statistical Significance:

*	*0.10*
**	*0.05*
***	*0.01*
****	*0.001*

Subject Separation:

To determine if there were differences between subject disciplines, an analysis was made on the plant nutrition and integrated pest management (IPM) sections separately. The Plant nutrition section contained 8 questions to quantify the grower's knowledge in those areas. The IPM section contained 10 questions.

RESULTS, Plant Nutrition

The average pretest score for all groups in this discipline was 1.9 out of 8 possible (Table 12). After the training sessions, the average posttest score increased to 4.88, resulting in a statistically significant difference ($p < .001$). From this we could conclude that the training sessions did improve the groups knowledge significantly, Table 13 (I vs. II). Additionally though, it was determined that pretest scores for those who attended the training sessions were higher (3.32,

Table 12) than those who did not attend (1.30), indicating that the growers attending were initially more knowledgeable than the larger group. However, after an analysis of the pre/post test scores for just those attending the training (I.a vs. II.a), it was determined that training sessions still improved scores significantly ($p < .05$), just at a slightly lower significance level.

TABLE 10. ASSESSMENT OF PRE- AND POSTTEST SCORES FOR FERTILIZER SCALE (Q61-Q68): Univariate Statistics

	Groups	*N*	*Mean Score*	*Standard Deviation*	*Minimum Score*	*Maximum Score*
I.	ALL PRETEST	29	1.90	2.18	0	8
a.	Pre/post Test	9	3.22	2.22	1	7
b.	Pretest Only	20	1.30	1.92	0	8
II.	ALL POSTTEST	17	4.88	1.83	2	8
a.	Pre/post Test	9	5.67	1.58	4	8
b.	Posttest Only	8	4.00	1.77	2	6
II.a.-I.a	Change in Scores Before vs. After Workshop for Pre/Post Test Group	9	2.44	0.818	0	5

TABLE 11. ASSESSMENT OF PRE- AND POSTTEST SCORES FOR FERTILIZER SCALE: Statistical Significance

Groups	*Comparisons*	*T-Test*	*DF*	*Prob.*	*Significance*
I. vs II.	All Pretest vs. All Posttest	4.75	44	.0001	****
I.a. vs II.a.	Pre/post Pretest vs. Pre/post Posttest	2.99	7	.0174	**
I.a. vs I.b.	Pretest Only vs. Pre/post Pretest	2.38	27	.0249	**
II.a. vs II.b.	Posttest Only vs Pre/post Posttest	2.05	15	.0583	---

Level of Statistical Significance:
* *0.10* ** *0.05* *** *0.01* **** *0.001*

RESULTS, Integrated Pest Management (IPM)

The average pretest score for the IPM questions was 2.03 out of 10 questions. After the training sessions the average posttest score increased to 4.59 (Table 10). A T-Test comparing all pretest vs. all posttest scores showed a statistically significant difference, $p < .01$ (Table 11), thus concluding that the seven training sessions did result in a significant increase in knowledge about IPM principles. A statistical analysis also confirmed that the growers attending the training were not more knowledgeable than the larger sample of growers.

TABLE 12. ASSESSMENT OF PRE- AND POSTTEST SCORES FOR IPM SCALE (Q50-Q60): Univariate Statistics

	Groups	*N*	*Mean Score*	*Standard Deviation*	*Minimum Score*	*Maximum Score*
I.	ALL PRETEST	29	2.03	1.35	0	4
a.	Pre/post Test	9	2.22	1.86	0	4
b.	Pretest Only	20	1.95	1.10	0	4
II.	ALL POSTTEST	17	4.59	2.50	0	9
a.	Pre/post Test	9	5.22	1.30	3	7
b.	Posttest Only	8	3.87	3.36	0	9
II.a.-I.a	Change in Scores Before vs. After Workshop for Pre/Post Test Group	9	3.00	0.897	-1	6

TABLE 13 ASSESSMENT OF PRE- AND POSTTEST SCORES FOR IPM SCALE: Statistical Significance

Groups	*Comparisons*	*T-Test*	*DF*	*Prob.*	*Significance*
I. vs II.	All Pretest vs. All Posttest	4.51	44	.0001	****
I.a. vs II.a.	Pre/post Pretest vs. Pre/post Posttest	3.34	7	.0102	**
I.a. vs I.b.	Pretest Only vs. Pre/post Pretest	0.50	27	.6240	---
II.a. vs II.b.	Posttest Only vs Pre/post Posttest	1.12	15	.2820	---

Level of Statistical Significance:
* *0.10* ** *0.05* *** *0.01* **** *0.001*

f) PROJECT EVALUATION

While the educational workshops were effective in improving farmer understanding of the topics as was predicted, there are certain methods and requirements to accomplish the desirable results.

It must be remembered that, like other small farmers, time is a valuable commodity and meetings are poorly attended unless the farmers will realize certain benefits. The checklist below summarizes the various techniques used here to accomplish our results. Farmer attendance may have been improved had we offered the classes during the winter months. We included some hands-on activities such as testing of their soil pH, salinity, and learning how to perform 'nitrogen quick tests.

√ translation into native language
√ approved continuing education for permits
√ scheduled meeting times that do no interfere with farm work
√ incentives such as certificates, complimentary educational materials
e.g. hand lenses, gloves/goggles
√ fewer classes and longer hours – possibly a Saturday class
√ more hands-on activities

g) Outreach Activities Summary

6/1-15/98 Individual surveys and pretest given to 14 farmers

8/06/98 First group training session – demographic and pretest, Introduction to plant nutrition, UC Cooperative Extension office in Fresno, 20 Asian farmers.

8/13/98 Second group training session – plant nutrition and marketing topics. UC Cooperative Extension office, 14 participants

8/20/98 Third group training session – fertilizer analysis, soil testing exercise, and vertebrate management, UC Cooperative Extension office, 17 participants

8/27/98 Fourth group training session - Chemical Safety, Fertilization formulations, Nitrogen "quick tests", and Crop Needs, Cooperative Extension Office, 14 participants

9/03/98 Fifth group training session – IPM, Fertilizer placement, and Insect management, Cooperative Extension office, 16 participants

9/10/98 Sixth group training session – Weeds, nutrient deficiencies, and posttest, Cooperative Extension office, 15 participants

9/17/98 Seventh group training session – Nitrogen Quick Tests, Posttest, Cooperative Extension Office, 17 participants

ATACHMENTS

1. Training Announcement and schedule
2. Training outline "Fertilizers and Plant Nutrition"
3. Training outline "Weeds and Chemical Labels"
4. Training outline "Insects, Diseases, and Pesticide Safety"
5. Training Outline "IPM and Fertilizers"
6. Training outline "Marketing Vegetables" (not included, N/A)
7. Training outline "Gophers and Squirrels" (not included, N/A)

APPENDIX

Survey Form