TEXAS DEPARTMENT OF AGRICULTURE

SPECIALTY CROP BLOCK GRANT PROGRAM

2011 FINAL REPORT

Grant # 12-25-B-1256

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Texas Department of Agriculture
2011 Specialty Crop Block Grant Program
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PROJECT 1: IMPROVING SAFETY OF TEXAS LEAFY VEGETABLES: PHASE 3

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Project Summary

Leafy vegetables, such as spinach, are responsible for 34 percent of produce related bacterial outbreaks in the United States. The foodborne illnesses in most of these outbreaks (86 percent) were caused by *Escherichia coli (E. coli)* O157:H7. In 2006, a multi-state outbreak of E. coli O157:H7 infections from Dole® pre-packaged spinach caused 276 consumer illnesses and three deaths.

In February 2007, Texas Citrus Mutual and the Texas Vegetable Association stressed the "interest of the produce industry in Texas in being proactive about food safety, particularly with leafy greens. Though Texas spinach was not involved in the recent E. coli outbreaks, some Texas growers were still hit with losses because of the associated recalls. For instance, Pentagon Produce in Uvalde County, Texas, was forced to dump $250,000 worth of spinach because of the issues in California during 2006. The recent food-borne microbial outbreaks call for innovative ways to prevent pathogen growth in fresh and fresh-cut produce while maintaining quality and safety. The Texas produce industry needs to step up and begin the process of developing a more robust food safety plan to protect both consumers and the fresh produce industry. Any effort less than this may be too costly." Just recently, organic baby spinach products were recalled in 39 states, including Texas, due to potential contamination with an E. coli strain (Huffington Post, February 14, 2013.) This microorganism is very infectious and it can be fatal to the elderly and small children.

This problem is not limited to E. coli. strains. Salmonella sickens about 40,000 people and kills approximately 600 in the U.S. each year. Although most cases of Salmonella poisoning are caused by undercooked eggs and chicken, several U.S. spinach producers had bagged baby spinach recalled for potential Salmonella contamination. In 2007, over 8,000 cartons of spinach from a California-based grower were recalled. Later, in 2011, a producer in California announced a recall of bagged spinach, following results that Salmonella was present in the product headed for the market. On October 19, 2011, Taylor Farms Retail, Inc. recalled 3,265 bags of various salad blends for concerns of contamination with Salmonella. Although still relatively uncommon, the frequency of these outbreaks is increasing, and tracing back to the source of contamination is practically impossible. In September 2012, testing of bagged spinach distributed by Kroger in 17 states revealed the product potentially contained *Listeria monocytogenes* bacteria. If eaten, the bacteria could lead to severe illness called listeriosis. Healthy people who ingest the bacteria may not get sick, but the elderly, women who are pregnant or people who have a weakened immune system are especially at risk (CBS news, September 20, 2012.)

This project continued the efforts from Phase 1 and 2 funded through the 2009 and 2010 Specialty Crop Block Grant on engineering, design, and dissemination of technologies to ensure the safety and quality of fresh leafy vegetables, while enhancing communication and management throughout the food chain. The approach consisted on combining the benefits of intervention strategies (such as washing and innovative approaches) with quantitative risk assessment methods, which is unique.

Current packinghouse practices (water washing and liquid sanitization treatments using chlorine) are not sufficient to ensure the safety of the produce when initial pathogen contamination loads are high, or when a substantial amount of pathogenic bacteria gets into the processed produce by cross-contamination. Hence, most fresh produce in the United States does not receive a lethality step to inactivate pathogens during processing and/or handling. Furthermore, recent studies indicate the internalization of pathogenic organisms into the core of leafy vegetables rather than contamination in the exposed surface only. This bacterial mobility makes surface treatments to reduce E. Coli O157:H7 ineffective. In addition, most of the commercially used interventions employ chemical agents, with detrimental effects on the organoleptic properties of the food. Thermal processing of fresh produce is not an option. In 2007, researchers and scientists gathered at the International lettuce and Leafy Greens Food Safety Research Conference in Virginia stated that "while there is a crucial need for a pasteurization process for lettuce and leafy greens, it is recognized that no current technology has a significant potential to accomplish this in the near future." The central hypothesis of this project was that an additional mitigating step (irradiation or combination with other pre-treatments) is the only way to "develop a more robust food safety plan to protect both consumers and the fresh produce industry." Such an assessment is crucial to support management decisions regarding process design and selection of appropriate technologies to ensure delivery of safe and healthy leafy greens to the consumer.

The project results demonstrate that use of innovative approaches such as Modified Atmosphere Packaging (MAP) or electron beam irradiation are effective in reducing microbial loads and decontamination, respectively.

A quantitative risk assessment is a systems-based approach that identifies and quantifies risks at each stage of the food supply chain, from harvest to consumer handling. However, no application is available to leafy vegetables, especially incorporating ionizing radiation, which has been shown to kill pathogens effectively. Hence, a risk-analytic framework will provide both an operational tool for ensuring safety, cost, and quality targets, as well as a strategic tool for guiding new investments and developing risk-based standards for global food safety.

Therefore, the main goals of this project were to (1) continue experiments to obtain reliable data to help establish the most cost effective intervention technology using quantitative risk analysis; and (2) develop recommendations to educate producers, processors, and consumers about the advantages of the technology(s).

The team completed data collection on growth curves of a third microorganism (*Listeria*) and conducted risk assessment analysis to provide recommendations for better handling

practices. Results from this project provide both an operational tool for ensuring safety, cost, and quality targets, as well as a strategic tool for guiding new investments and developing risk-based standards for global food safety. This knowledge is critical because Texas producers are willing to try new technologies, but they have little or no information on benefits and cost analysis of intervention technologies.

Project Approach

The list below summarizes the key activities and tasks performed, and major developments. Specific details are provided in the Goals and Outcomes Achieved section.

1) Developed a quantitative growth model for *Listeria* strains in ready-to-eat baby spinach.
2) Finalized data collection on the effect of competition by natural microflora existing in the produce.
3) Assessed the impact of intervention strategies.
4) Fine-tuned the risk assessment tool to incorporate data on E. coli (publication in progress).

Goals and Outcomes Achieved

Goal 1. Calibrate and validate the risk assessment tool as a quantitative measure of effect of handling practices on potential outbreaks in leafy vegetables such as baby spinach using actual experimental data.

✓ ***Activity 1:*** Texas A&M AgriLife team completed data collection on experimental growth curves of *Salmonella,* and *E. coli* at different storage temperatures. These data were used as input to the risk assessment tool to assess the probability of an outbreak due to growth of these pathogens when the leafy greens (spinach) are exposed to storage temperature fluctuations. Since bacterial outbreaks are likely triggered by relatively infrequent instances of very high pathogenic load, common cooling and handling practices were mimicked by evaluating the growth of the pathogen (*E. coli* or *Salmonella*) under four different temperature scenarios.

Result: The main findings from the study were published in one peer-reviewed article entitled *Modeling the growth rates of E. coli spp. and Salmonella Typhimurium LT2 in baby spinach leaves under slow cooling* (A.F. Puerta-Gomez, R.G. Moreira, J. Kim, and E. Castell-Perez.) 2013. Food Control 29, 11-17. doi: http://dx.doi.org/10.1016/j.foodcont.2012.05.070.

✓ ***Activity 2:*** In July 2012, the Texas A&M AgriLife team finalized the collection of experimental growth curves for *Listeria*. The team determined that adding studies on *Listeria* were necessary because this pathogen is the most resistant to irradiation treatment. In addition, it is well known that *Listeria monocytogenes* is one of the few foodborne pathogens capable of multiplying under refrigerated temperatures. However, the growing pattern of *Listeria spp.* (multiple species) in competitive scenarios that occur in the presence of natural microbiota on the surface of the fresh produce has not been thoroughly investigated. The primary goal of this additional study was to evaluate the initial level of *Listeria spp.* and natural microbiota load on the surface of baby spinach leaves and their interaction on the growth behavior of *Listeria spp*. at different storage temperatures.

Result: Following are some *critical findings*:

(a) Unlike the other pathogens studied (e.g. *Salmonella typhimurium* LT2 and *E. coli* spp.), *Listeria innocua* grew at refrigerated temperatures (5°C) when the ratio between natural microbiota mesophiles was below two for a 2-log CFU/gr initial *Listeria* inoculum. In the case of a 3-log CFU/g initial *Listeria* inoculum, a reduced growth rate was observed in comparison to the case of a 2-log CFU/g of initial inoculum, even though the mesophile microbiota to *Listeria* ratio was below 1 (least competitive scenario).
(b) A ratio of natural mesophile microbiota to *Listeria* colonies greater than two precluded the growth -- and even reduced -- the initial level of *Listeria* contamination on baby spinach stored at 5°C.
(c) The growth of *Listeria* innocua at 10°C and 20°C was less affected by the presence of mesophile microbiota. However, even for the more competitive scenario (a ratio of three), *Listeria* showed a substantial growth at these two temperatures.
(d) No restriction on the growth of *Listeria* due to the presence of natural microbiota was observed at higher temperature conditions, 30°C, or 37°C.
(e) Washing the spinach leaves with chlorinated water only reduced the number of *Listeria* counts by half when compared to the reduction of *Salmonella* and *E. coli spp*. counts.

In summary, because *Listeria* is capable of multiplying under refrigerated temperatures with certain levels of competition, processed fresh leafy greens are at high risk because the application of washing treatments (such as washing with chlorine) reduces the level of initial microbiota. Subsequently, this exposes the produce to cross-contamination and rapid growth of *Listeria* at storage temperatures (e.g. 5°C) may occur. For this reason, different intervention strategies must be used when dealing with different types of pathogenic microorganisms. *A publication of these results is currently in preparation.*

Goal 2. Implementation of risk management tool and development of recommendations.

This goal was achieved for evaluation of potential risks of contamination of spinach leaves with *Salmonella*, *E. coli*. and *Listeria.* Texas A&M AgriLife team completed fine-tuning of the risk assessment tool to quantify the effect of handling practices on potential outbreaks in leafy vegetables, using actual experimental data. The quantitative risk assessment model developed in this study can be effectively used to estimate the effect of mitigation strategies to avoid potential outbreaks.

- ✓ ***Activity 1:*** Texas A&M AgriLife team completed a risk assessment analysis of experimental growth curves of *Salmonella and E. coli.* A comprehensive assessment of the effect of process parameters (washing step, irradiation dose, sterilizing agents, storage temperature, etc.) on minimizing potential of pathogen contamination and consequent outbreaks was completed. Results yielded information that helped understand the impact of produce handling on potential for pathogen contamination. For instance, the team members assessed the impact (if any) of different combinations of mitigation strategies (washing with chlorinated water and irradiation) on the number of pathogens present in ready-to-eat baby spinach.

  Result: Some recommendations include:

1. Liquid intervention methods such as washing with water or chlorine only reduced at most 2-log of surface microbial population and the organic load values could reduce even more their efficacy as sanitizers. Consequently, producers of leafy greens should control their washing water sanitation procedures to assure a maximum efficacy. This can be achieved by monitoring organic load numbers (i.e. the soil that is carried by the leaves during harvesting and the subsequent contamination of the washing water in a commercial scale washing procedure, reducing the efficacy of the liquid sanitizer), and quantifying the maximum inactivation capacity of the initial microbial population. This could be achieved by monitoring microbial counts in bagged products, water turbidity, water temperature, and Oxidation Reduction Potential (ORP).
2. Cross-contamination seemed the most probable scenario for prevalence of contamination on an entire lot of daily production. It should be recommended that intervention strategies be implemented when cooling practices are slow or temperature fluctuations occur. For instance, the spinach processor would be able to deliver a highly safe product in a cross-contamination scenario (on the field or packing shed) if the produce were harvested at $20^{o}C$, stored for at least 5 hours, washed with water and chlorine (220 ppm), and exposed to irradiation treatment with a dose of 1 kilogray (kGy).
3. Sampling procedures in critical control points and bagged product, such as the frequency of sampling, sampling size (significant number of bagged products tested) and rapid detection methods must be established, constantly evaluated, and validated to improve the limits and efficacy of detection for possible pathogen contamination at the most effective cost-benefit interest.
4. In the case of high-level cross-contamination, the bagged spinach would need to be irradiated at doses higher than 1 kGy to reduce the probability of infection close to a zero value. These higher irradiation doses could cause detrimental effects on the quality of the spinach leaves, like discoloration, wilting, and off-odor, thus reducing their shelf life. The need is to implement steps to reduce the dose required to decontaminate the spinach leaves with minimal changes in quality. These steps are named 'radiosensitization' strategies, with Modified Atmosphere Packaging (MAP) being one example.
5. Intervention steps such as MAP to reduce the required radiation dose should be encouraged. For instance, 3 percent of the bagged spinach samples exceeded the safety limit when irradiated in air, about 0.9 percent in a N_2:O_2 packaging atmosphere and, only 0.6 percent for the samples irradiated under 100 percent O_2. As a result, the bagged spinach will be free from pathogens while maintaining its wholesomeness.
6. Finally, to increase the accuracy of the risk assessment model, the variability of cross-contamination distribution population in pilot plant or commercial scenarios must be determined; thus increasing the ability to reduce the number of uncertainties in the risk assessment model and its accuracy in estimation of infection probability.

   Result: The main findings from the study (only for *Salmonella*) were published in one peer-reviewed article entitled *Quantitative assessment of the effectiveness of intervention steps to reduce the risk of contamination of ready-to-eat baby spinach with Salmonella* (Puerta-Gomez, A., Kim, J., Moreira, R.G., Klutke, G.-A, and Castell-Perez, M.E.) 2013. Food Control. Accepted October 2012. doi: 10.1016/j.foodcont.2012.10.022. Publication of results for *E. coli* are in progress.

- ✓ ***Activity 2:*** Texas A&M AgriLife team initiated the risk assessment analysis of growth of *E. co*li and *Listeria under different scenarios*

Result: Tables 1 and 2 below show the inputs to the risk assessment tool and Figures 1 and 2 show the probability of infection for the different scenaroios *for* E. coli and *Listeria*, respectively. Several cross-contamination scenarios were evaluated assuming two types of distribution of bacterial load, a normal distribution (based on mean and standard deviation) and a skewed (big standard deviation) one-direction distribution such as the lognormal distribution. The assumption of symmetrically or heavily skewed distributed 1-log CFU/g of contamination from the fields or during the packing process was defined as Scenario #1 and Scenario #2, respectively. Other scenarios with higher level of cross-contamination were also evaluated. Scenarios # 4 and #5 include an irradiation intervention step.

In brief, *Listeria* showed the lowest probability of infection at each scenario compared to *E. coli* and *Salmonella.* These results are consistent with the fact that *Salmonella* spp. is linked with the most reported cases of foodborn outbreaks, followed by *E. coli*. Assessment of intervention strategies on the growth of *Listeria* is in progress and will be completed by April 2013. *Publication of these results is in progres*s.

Table 1: Summary of the model parameters and calculated values for the six different scenarios of the probability of an infective dose of *E. coli spp*. in baby-spinach leaves.

	Scenario #					
	1	**2**	**3**	**4**	**5**	**6**
Initial microbial load in infected samples [log CFU/g]	1	10^{-5}	10^{-5}	10^{-5}	10^{-5}	10^{-5}
Harvesting temperature [^{o}C]	20	20	20	20	20	20
Holding time at that temperature [hour]	5	5	5	5	5	5
Cross-contamination levels after water washing and chemical treatment, microbial load [log CFU/g]	0	1	2	2	3	3
Lognormal Distribution (μ, σ) contamination	(1,0.7)	(1,0.7)	(2,1.0)	(2,1.0)	(3,1.0)	(3,1.0)
Irradiation dose [kGy]	0	0	0	1	0	1
Microbial prevalence [log CFU/g]						
Post water washing [log CFU/g]	0.73	-0.27	-0.27	-0.27	-0.27	-0.27
Post chlorinated water washing [log CFU/g]	-0.27	-1.27	-1.27	-1.27	-1.27	-1.27
Baby-spinach leaves at consumption [log CFU/g]	-0.2679	-0.2679	0.7321	-4.6250	1.7321	-3.625
Median log probability of positive leaves being infectious	-3.215	-3.215	-2.216	-7.572	-1.2279	-6.572
Percentage of samples over the safety limit ($P_{IF} > 10^{-2}$). Based in Lognormal Distribution (σ=1.0)	7.8%	7.9%	36.3%	0.1%	75.7%	0.2%

r = 1.13 x 10^{-3} (S. O. Tromp, H. Rijgersberg, annd E. Franz. 2010. Quantitative Microbial Risk Assessment for Escherichia coli O157:H7, Salmonella enterica, and Listeria monocytogenes in Leafy Green Vegetables Consumed at Salad Bars, Based on Modeling Supply Chain Logistics. Journal of Food Protection, Vol. 73, No. 10, 2010, Pages 1830–1840)

Table 2: Summary of the model parameters and calculated values for the six different scenarios of the probability of an infective dose of Listeria spp. in baby-spinach leaves.

	Scenario #					
	1	**2**	**3**	**4**	**5**	**6**
Initial microbial load in infected samples [log CFU/g]	1	10^{-5}	10^{-5}	10^{-5}	10^{-5}	10^{-5}
Harvesting temperature [^{o}C]	20	20	20	20	20	20
Holding time at that temperature [hour]	5	5	5	5	5	5
Cross-contamination levels after water washing and chemical treatment, microbial load [log CFU/g]	0	1	2	2	3	3
Lognormal Distribution (μ, σ) contamination	(1,0.7)	(1,0.7)	(2,1.0)	(2,1.0)	(3,1.0)	(3,1.0)
Irradiation dose [kGy]	0	0	0	1	0	1
Microbial prevalence [log CFU/g]						
Post water washing [log CFU/g]	0.77	-0.23	-0.23	-0.23	-0.23	-0.23
Post chlorinated water washing [log CFU/g]	0.23	-0.77	-0.77	-0.77	-0.77	-0.77
Baby-spinach leaves at consumption [log CFU/g]	0.2302	0.2302	1.2302	-3.4645	2.230	-2.465
Median log probability of positive leaves being infectious	-9.488	-9.488	-8.4887	-13.183	-7.489	-12.18
Percentage of samples over the safety limit ($P_{IF} > 10^{-2}$). Based in Lognormal Distribution (σ=1.0)	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%

r = 1.91 x 10^{-10} (S. O. Tromp, H. Rijgersberg, annd E. Franz. 2010. Quantitative Microbial Risk Assessment for Escherichia coli O157:H7, Salmonella enterica, and Listeria monocytogenes in Leafy Green Vegetables Consumed at Salad Bars, Based on Modeling Supply Chain Logistics. Journal of Food Protection, Vol. 73, No. 10, 2010, Pages 1830–1840).

Figure 1: Probability of *E. coli* infection occurrence at different distribution for scenarios #1 to #6

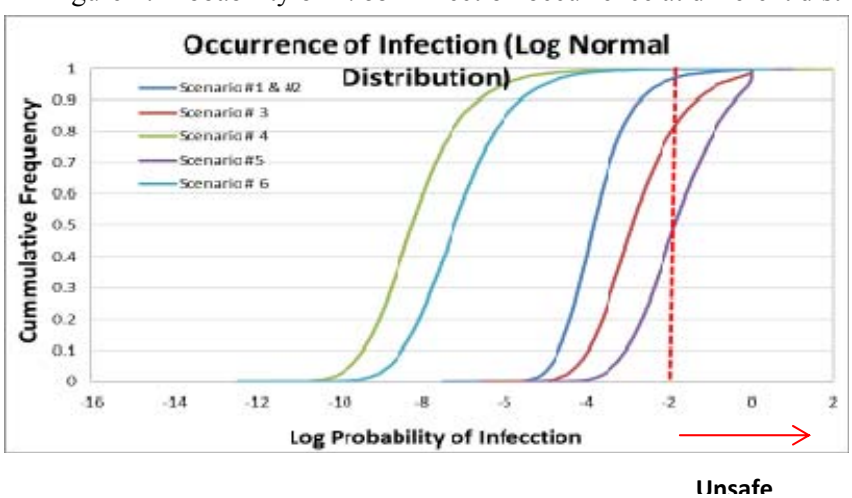
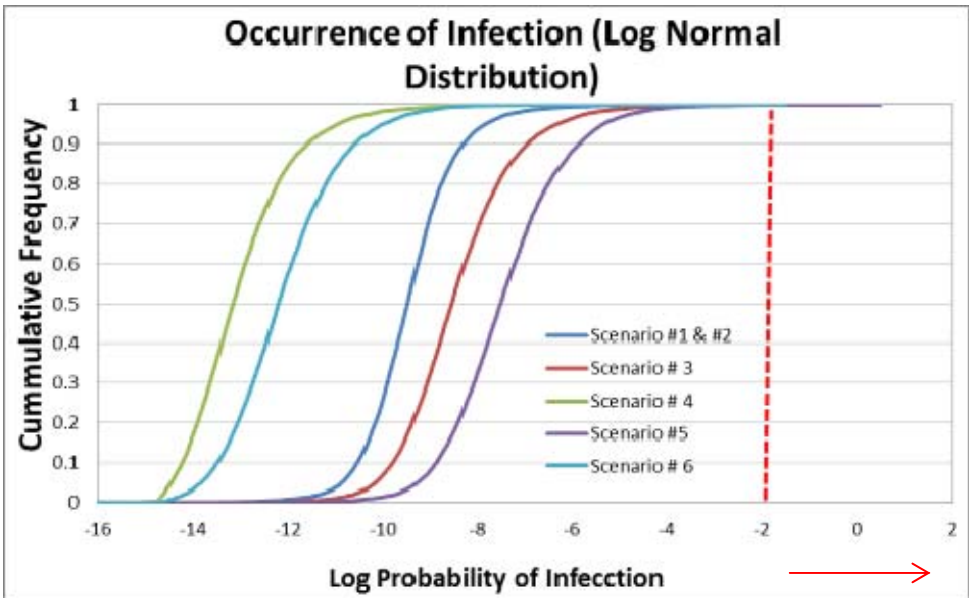


Figure 2: Probability of *Listeria* infection occurrence at different distribution for scenarios #1 to #6



Unsafe product

Goal 3. Increase the number of leafy vegetable producers understanding the recommendations.

The team was unable to hold an onsite workshop as planned. See details in the *Lessons learned* section on the amount of work that went into planning of the workshop and why it was not successful.

Although the team was unable to hold an onsite workshop due to scheduling problems and lack of available facilities at Texas A&M due to building renovations, the team decided to disseminate the information by participating at national conferences and publishing the research findings.

- ✓ ***Activity 1:*** The Texas A&M AgriLife team added information from previous visits to two local producers to on handling practices and microbiological analyses performed on site to the risk assessment tool. These local producers are aware of the findings and supportive of the study.
- ✓ ***Activity 2:*** The main research findings (from *Goal 2)* were presented at the Institute of Food Technologists (IFT) International Annual Meeting held in Las Vegas, June 25-28, 2012, in the form of two posters. Approximately 15,000 people from industry, government, and academia attended this event and the posters sessions were extremely interactive. Team members had the opportunity to answer questions from attendees regarding the functionality and availability of the risk assessment tool.
  Result: Posters presented (the abstracts published in the Conference Book of Abstracts are provided in the **Additional Information** section)

(1) *Comparison of growth rates of Escherichia Coli spp. and Salmonella Typhimurium LT2 in baby spinach leaves (Spinacea oleracea) under slow cooling* by A.F. Puerta-Gomez, R.G. Moreira, J. Kim, and E. Castell-Perez.

(2) *Development of a quantitative risk assessment model for Salmonella Typhimurium in fresh baby spinach*. Puerta-Gomez, A., Kim, J., Moreira, R.G., Castell-Perez, M.E. and Klutke, G.-A.

Project staff estimates that at least 30 individuals interested in specialty crop production were engaged in direct communication with the presenters of the posters at the conferences. In most cases, a copy of the poster and publications was sent to these individuals via e-mail upon their request. These individuals were extension faculty with expertise in fresh produce, faculty members at universities, and scientists working in food companies dealing with fresh produce.

Goal 4. Increase the number of producers following the guidelines derived from Goal 2.
Performance measure: Set up implementation plans for particular producers.
Benchmark: Currently, guidelines on the proposed technologies do not exist.
Target: Visit producers and determine effectiveness of recommended implementation plan.

- ✓ ***Activity 1:*** Activities for this goal are still in progress. The Texas A&M AgriLife team was unable to schedue a workshop but still plans to do it. One option is to prepare material for online delivery. Producers and processors will learn about ways to mitigate decontamination with pathogens, how to test their products during handling, and to assess the effectiveness of intervention steps along the processing/packing chain. In addition, attendees will be provided with a series of practical recommendations to ensure the safety of their produce at the packinghouses and storage facilities. A date for delivery of the educational materials is still to be determined.

The information presented in the posters was also disseminated in the form of two publications in *Food Control*, a professional journal consulted by scientists and extension faculty' volume 29(1), 2013 – pages 11-17 http://dx.doi.org/10.1016/j.foodcont.2012.05.070 and volume 31(2), 2013, pages 410-418.http://dx.doi.org/10.1016/j.foodcont.2012.10.022. These publications are accessible to extension faculty with expertise in specialty crops who can help disseminate the information via personal communication or when conducting visits to producers' locations. At this point, we cannot determine how many specialty crop producers have been provided this information.

There are at least three more articles being prepared for publication based on findings from this project regarding *Listeria monoytogenes*. Access to these publications by extension agents and specialty crop industry personnel will help disseminate the information – though we cannot estimate the numbers at this point. We will also develop some short Extension publications to facilitate dissemination of the information to producers.

In summary,

1. A growth model for *Listeria* strains in ready-to-eat baby spinach is now available. This model predicts microbial growth as a function of temperature and can be used to evaluate the impact of handling practices such as cooling and storage on the growth of *Listeria* in the leafy green evaluated in this project.

2. The team evaluated the effect of natural mesophile microbiota on the ability of *Listeria innocua* to grow during cold storage (e.g. 5°C).
3. The team assessed whether the initial microbial load would affect the effectiveness of washing treatments on reducing the growth of Listeria. Washing with chlorinated water seems to be less effective for *Listeria* than for *E. coli* and *Salmonella*, making the case for the need for a killing (intervention) step.
4. Risk assessment principles with scenario analysis and predictive microbiology provide an objective assessment of the safety characteristics of the packinghouse process and allow the manufacturer to predict outcomes before actual implementation.
5. The team worked well together and all partners provided equal and important contributions to the progress of the project.
6. Findings from the project have been disseminated at the national level.

Beneficiaries

This project will benefit over 50 Texas leafy vegetables producers (spinach, cabbage, cilantro, parsley) and eventually the U.S. consumer. Specific recommendations regarding cooling practices and intervention steps provide the fresh produce industry some guidelines to evaluate their own baby spinach cooling practices at the collection facility as well as during handling and distribution to minimize the risk of *Salmonella, E. Coli,* and *Listeria* growth. This practice could significantly avoid economic losses due to produce recalls.

Lessons Learned

The team learned that by careful planning and scheduling of tasks to each member of the team resulted in completion of the tasks as planned. No significant problems were encountered by the team with the exception of the difficulty in scheduling a workshop in a suitable location. Below is a detailed explanation of what was done to plan and hold the workshop and why it did not work.

December 2011 – the 3 PIs had telephone discussions on tentative dates to hold a workshop. The extension PI contacted several producers and came back with potential dates of February or June 2012. After that, it was decided that the February date would not give enough time to plan and hold a worthy workshop.

January 2012 - The team members (3 PIs and 1 graduate student) discussed what was needed to plan and hold a workshop at a centralized location. Weslaco or San Antonio, Texas was easily accessible to a majority of leafy green processors and producers. The team developed a tentative outline of the content of the workshop (see additional information).

Extension PI followed up with potential attendees to confirm the date and location. Research PIs and students continued data collection on three pathogens and analysis of the results from the risk assessment tool.

By March 2012, it became clear that finding a suitable time for an off-campus event during the summer would be difficult. All PIs had unexpected international travel commitments

during the summer that could not be postponed. The plan was then to hold the conference in the fall (September-December 2012 with a preference for an early September date). Initially, PIs considered holding the workshop at the Texas A&M campus in College Station. However, this plan quickly dissolved because the selected site was going to begin considerable renovation work and project staff needed to relocate their labs to a different building during that time. The PIs really worked hard at finding another location on campus but were unsuccessful due to the many teaching and professional commitments already scheduled throughout the semester. Although the PIs reconsidered the off campus workshop, the PIs' teaching and other professional commitments made this difficult. The building that houses the Department of Biological and Agricultural Engineering, the original workshop location, has been undergoing considerable construction work and it will only end in 2015.

We learned that future projects should have a "Plan B" for development of online workshops since we were unable to hold the in face workshops due to scheduling conflicts and the lack of a suitable location to accommodate workshop participants.

As stated before, the team is still working on updating the TAMU Food Safety website to post educational materials online based on results from the project. Project staff plans to share information about the availability with the Texas Department of Agriculture as soon as we complete this task.

The team members believe that they still must complete the proposed task and hold an event that helps increase the understanding of specialty crop producers of the impact of the research findings on future fresh produce handling procedures and safety.

It is the honest intention of the team members to complete the proposed plan to hold a workshop. The anticipated date will be the summer of 2015 (renovations of building and labs will be complete by January 2015.) The workshop will be held at no cost to USDA or TDA.

Additional Information:

Presentations:

Two poster presentations were made at the Institute of Food Technologists (IFT) Annual International Meeting in Las Vegas June 2012. The posters highlighted the results from prediction of the growth of *Salmonella* and *E. coli* in baby spinach leaves. No such results were available before. The abstracts are presented below:

1. Comparison of growth rates of Escherichia Coli spp. and Salmonella Typhimurium LT2 in baby spinach leaves (Spinacea olerac) under slow cooling

PUERTA-GOMEZ, A.F., R.G. Moreira, J. Kim, and E. Castell-Perez, Dept. of Biological and Agricultural Engineering and Dept. of Animal Science, Texas A&M University, College Station, TX 77843-2117

After field harvest, baby spinach is transported to the packing shed where it is cooled by forced air systems. If contaminated, the temperature of spinaches will affect the number of pathogens in the leaves, and effective temperature control is critical to restrict their growth.

Hence, the need to assess the impact of cooling practices on the growth of pathogens in leafy greens.

Ten-gram portions of baby spinach leaves were dispensed into sterile stomacher bags (18 oz and inoculated with 1 mL of 10^4 CFU/ml of *Salmonella* Typhimurium LT2 or 10^2 CFU/ml of an *E. Coli* cocktail (BAA-1427, BAA-1428, and BAA-1430), and vigorously shaken for 1 min to spread the inoculums over the sample. Five bags were prepared for each sampling time. The inoculated samples were placed in an incubator maintained at constant temperature (10, 20, 30, and 37°C) for 30 hours.

At 10-30°C, the *E. coli* strains grew significantly more (~2-4 log cycles) than the *Salmonella* strain (~0.11-2.4 log cycles) while at 37°C, both bacterial populations increased by ~6 log cycles for 30 hours. The growth kinetics of each microorganism followed the Baranyi model. The maximum bacterial population increased with temperature and the values were similar for both bacteria. The theoretical minimum temperature was 5.88^{o}C and 4.76^{o}C for *Salmonella* and *E. coli,* respectively. The dynamic model was validated with an experimental linear cooling profile from 30 to 5°C in 5 hours (cooling rate of 0.087^{o}C/min).

A growth model for *Salmonella* and *E. coli* in ready-to-eat baby spinach is now available. The predictive model could be incorporated into a risk assessment tool to assess factors affecting pathogen growth in baby spinach during processing and distribution. These results illustrate that understanding the growth kinetics of different microorganisms on the surface of spinach leaves is critical for design of spinach post-harvest (cooling) practices.

2. Development of a quantitative risk assessment model for Salmonella Typhimurium in fresh baby spinach

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Quantitative risk assessment is a probabilistic-based approach that identifies and quantifies risks at each stage of the food supply chain, from harvest to consumer handling. Few applications are available for leafy vegetables; and very little effort has been done on the incorporation of treatments, which effectively kill pathogens such as ionizing radiation.

Our objective was to develop a quantitative risk assessment model to analyze microbial hazards of baby spinach during processing and the impact of intervention strategies.

Initial distribution of pathogens, predictive microbiology models for growth and the effect of several intervention strategies (water and chlorine washing, ionizing radiation) were integrated to create the risk assessment model. Monte Carlo simulation, a stochastic approach, was used to take into account the variability of the model parameters (input and output).

According to published data, cross-contamination seems to be the more plausible scenario for prevalence of pathogen contamination on an entire lot of daily production. In the case of low cross-contamination level of bacteria (1 $\log_{10}$CFU/g, normal distribution) either on the field or after washing or application of a chemical treatment, the percentage of samples over the safety limit (1.33 $\log_{10}$CFU/g of sample) increased from 16.8 percent to 84 percent for a highly cross-contaminated lot (3 $\log_{10}$CFU/g). The risk assessment model indicated that ionizing radiation reduces the number of samples that carry a contamination load over the safety limit from 84 percent to 0.1 percent, for highly cross-contaminated lots.

This risk assessment analysis confirms that ionizing radiation at 1 kGy (*Salmonella* spp. D_{10}-value is 0.19 kGy) after washing provides a highly safe product in a cross-contamination scenario (on the field or packing shed). Other good practices include low harvesting temperature (20°C) for average time of 5 hours, water washing, and chlorine washing (200 ppm).

This model can predict the effects of mitigation strategies to avoid future outbreaks.

Workshop Questions and Survey

Workshop outline

IMPROVING SAFETY OF TEXAS LEAFY VEGETABLES

10:00 a.m. – 3:00 p.m.

Location: TBD

Attendance: 30-50 individuals including extension agents, fresh produce processors, and producers

1. Introductions
   Distribution of handouts/brochures/folders
2. Workshop objectives – Moreira

3. Overview of the problem
   - Safety of leafy greens – the case of spinach – Best Practices - Anciso
   - The need for alternative treatments – Castell-Perez
   - Intervention strategies and approaches – Moreira
   - Allotted time for questions and comments
4. Description of Research Methodology used – Moreira
   - Identification of pathogens responsible for recalls of leafy green vegetables and why we studied them
   - Flow chart of a spinach processing flow diagram highlighting problem spots and proposed intervention steps.
   - Problem spots

- Current versus new practices
- Basics of the risk assessment model
- What relevant information can be obtained from it?
- What does it mean?
- Applications to other leafy greens (lettuce) and specialty crops

5. Lunch break (discussion went on about having a working lunch where participants will answer a series of questions, provide questions for afternoon discussion
6. Results from research
   - Demonstration of risk assessment tool
   - Presentation of several risk scenarios and the impact of intervention steps in preventing outbreaks – Moreira
   - Effect of intervention strategies on probability of risk – Castell-Perez
   - Recommendations – All PIs
7. Discussion session/ Q&A session? (it will be good to hear from producers regarding their concerns, etc.)
   - Impact of assessment tool to participants
   - Future steps
   - What should we do next?
8. Exit survey to assess the effectiveness of the workshop (to be developed with assistance from extension personnel)
   - See below a preliminary evaluation tool developed by the team.
   - We also considered a shorter version of the survey which focused on the disseminated new information and establishment of follow-ups with leafy vegetable producers to assess the effect of the information on the number of producers/processors.
9. Adjourn by 3:00 p.m. - TBD

Workshop Survey and Evaluation

IMPROVING SAFETY OF TEXAS LEAFY VEGETABLES

Please complete the following questions. Your frank and honest feedback is valued. Thank you in advance for your time and thoughtfulness.

1. *Overall, what aspects of the workshop were most valuable?*
2. *How did participating in this program change your outlook of food safety issues regarding leafy greens?*
3. *How has your knowledge of safety of leafy vegetables changed/grown because of participating in the workshop?*
4. *Name at least 3 concepts you learned/or where deepened for you from the workshop*
5. *How do you think the information obtained from the workshop will affect you?*
6. *Discuss your experience in terms of the benefits, learning, applications, etc.*
7. *Was the working lunch useful to you? Why or Why not?*
8. *Was the afternoon discussion useful to you? Why or Why not?*

9. *What about this discussion did you find most valuable?*
10. *Describe at least two things that worked well in the workshop and explain why you believe they worked well.*
11. *What things would you add to improve future workshops?*
12. *Will you consider participating in another workshop in this topic? Explain why or why not.*
13. *Would you recommend this program to others?*
14. *Other comments you would like to make.*

Please provide your name if you are comfortable. All responses will be held in confidence
NAME: _____

Workshop Survey – Short version

IMPROVING SAFETY OF TEXAS LEAFY VEGETABLES

Please complete the following questions. Your frank and honest feedback is valued. Thank you in advance for your time and thoughtfulness.

1. *How has your knowledge of safety of leafy vegetables changed/grown because of participating in the workshop?*
2. *Name at least 3 concepts you learned/or where deepened for you from the workshop*
3. *How do you think the information obtained from the workshop will affect you?*
4. *Will you consider implementing some of the recommendations presented in this workshop? Why or Why not?*
5. *What about this workshop did you find most valuable?*
6. *Will you be interested in a visit form the PIs to your location to continue the discussion? Why or why not?*
7. *Other comments you would like to make.*

Please provide your name so we can follow up with you regarding potential site visits and sharing of new information regarding safety of leafy greens.

NAME: _____

Extension PI followed up with potential attendees to confirm the date and location. Research PIs and students continued data collection on three pathogens and analysis of the results from the risk assessment tool.

PROJECT 2: ENVIRONMENTAL IMPACT AND BEST MANAGEMENT PRACTICES FOR OLIVE (OLEA EUROPAEA L.) OIL PRODUCTION IN TEXAS

Partner Organization: Texas Tech University
Project Manager: Dr. Thayne Montague, thayne.montague@ttu.edu
Type of Report: Final Report
Date Submitted: December 2012

Project Summary

As of 2012, little regional research has been conducted on Texas olive production for oil. As a newly cultivated specialty crop for Texas, research investigating production practices and management tools for Texas olive production is lacking. This is especially important because there are several climatic regions within the state that appear suitable for olive production. In the first two years of work, funded under 2009 and 2010 Specialty Crop Block Grants, project staff, initiated replicated greenhouse and field studies to determine the impact of temperature, soil type, and irrigation frequency on olive cultivars grown for oil within Texas. As this work progresses, other production issues have surfaced. For example, weed management impacts irrigation, fertility and olive yield while soil flora and mulching practices impacts tree fertility. Previous work in these areas has been conducted under very different climates rendering results of limited use. The purpose of this study was to continue the identification of environmental impact and best management practices for initiation and continued cropping of sustainable olive orchards in Texas.

Project Approach

Activities for this project began in fall 2011 and carried through until December 2012. Early on, graduate students Kaylee Whitehurst Decker and Vikram Baliga performed much of the "hands on" work (data collection, experiment upkeep, etc.) set forth in the grant proposal. Data collecting was completed at the orchards in Carrizo Springs and Asherton, Texas. In addition, several olive producers contributed time and in kind donations (orchard trees, labor, etc.) which helped with completion of this project. For 2011 – 2012, research focused in the following areas:

Plant physiology and oil quality of olive trees as influenced by irrigation regime: With costs of energy increasing and water availability decreasing, accurate irrigation volume application is of key concern for olive producers. Research was conducted on field grown olive trees in two orchards Conly orchard (Asherton, Texas), and Texas Olive Ranch (Carrizo Springs, Texas) using one olive variety ('Arbequina'). Research investigated variable irrigation regimes (low, medium, and high treatments based upon "normal" orchard production practices) and the influence on tree physiology (transpiration and photosynthetic rate), fruit production, and growth. At each of these orchards, greatest transpiration and photosynthetic rates were not always associated with greater irrigation rates. Means for the entire growing season indicate trees receiving the medium irrigation rate at Texas Olive Ranch had similar photosynthetic rates when compared to trees receiving other amounts of irrigation. Trees at Texas Olive Ranch had greater water use efficiency when compared to trees at Conly Orchard. Data also suggest trees at Conly Orchard had greater transpiration

and photosynthetic rates. Irrigation data (not yet entirely gathered) indicate trees at Conly Orchard likely received greater amounts of irrigation when compared to trees at Texas Olive Ranch. This would explain why trees at Conly Orchard had greater gas exchange rates, but lower water use efficiency. Shoot growth data indicate greater shoot growth for trees receiving the high irrigation treatment, and trees at Conly Orchard had greater shoot growth when compared to trees at Texas Olive Ranch. Greater shoot growth is not a desirable trait for olive oil production (more carbohydrates should be going to fruit production). Greater shoot growth is another indicator of excess irrigation at Conly Orchard. Physiological and growth data indicate potential irrigation savings could be implemented at Conly Orchard.

Although there was good olive oil production for many orchards during the 2012 growing season, due to insect predation, fruit production for experimental trees at Texas Olive Ranch was very limited. Fruit production on experimental trees at Conly Orchard was zero. Due to limited fruit production, olive oil was not pressed or analyzed from experimental trees at either orchard.

Regional climatic factors influence on bloom and fruit set: Because cold and heat influence olive bloom and fruit production, the purpose of this portion of the project was to gather bloom and fruiting data from existing olive orchards belonging to Texas Olive Oil Council members. This work was initiated spring 2010. Project staff worked with nine producers who agreed to send investigators flower bloom and fruit set data. Unfortunately, producers who agreed to participate did not collect desired data. Therefore, staff will be working with producers on correct data collection methodology.

Occurrence of mycorrhizae in olive orchards and influence of mycorrhizae on olive tree water relations: Previous research by principle investigators found mycorrhizae can influence nutrient on uptake and likely productivity of olive orchards. Therefore, two orchards were sampled for presence of existing mycorrhizae. Root samples were taken from 'Arbequina' trees at Conly Orchard trees in June of 2012, and samples were collected from 'Arbequina' trees at Texas Olive Ranch trees in August of 2012. The shape of the vesicles found in the Conly Orchard samples indicate roots are colonized by a species of *Glomus* mycorrhizae. Root samples from Texas Olive Ranch trees are currently being analyzed for mycorrhizae. The next phase of the project will be to determine drought tolerance of olive plants with or without mycorrhizal colonization under controlled conditions. Inoculum obtained from the field and from research collections will be compared.

Weed control in olive orchards: Weed control is critical during initial establishment and long-term productivity of olive trees. Therefore, the purpose of the activity was to investigate grower weed management options. In spring and summer of 2012, field experiments were conducted at the Central Texas Olive Ranch in Walburg, Texas to evaluate the efficacy of mulch and/or preemergence herbicides for weed control in high density olive production. Treatments consisted of isoxaben, oryzalin, oxadiazon, and mesotrione. Hardwood mulch (to a depth of 6 cm) was applied to half of each plot immediately following irrigation. A non-treated check was included for comparison purposes. Results this season were similar to results from the 2011 growing season. Phytotoxicity to olive trees was not observed throughout the trial. All preemergence herbicides exhibited ≥ 90 percent weed control at 4

and 12 weeks after treatment. Mulch alone provided approximately 70 percent weed control. Addition of mulch did not enhance herbicide efficacy.

Similar to 2011, at the same location as the above experiment, in the spring of 2012 an experiment evaluated efficacy of postemergence herbicides for weed control in high density olive production. Results of this experiment were also similar to the 2011 experiment. Tree phytotoxicity was not observed throughout the length of the trial. Four weeks after initial treatment single applications of metsulfuron and glyphosate exhibited 35 and 37 percent weed control respectively. All other single application treatments exhibited ≤ 20 percent control 4 weeks after initial treatment. Sequential applications of metsulfuron, mesotrione, and aminocyclopyrachlor exhibited 40 to 60 percent weed control 8 weeks after initial treatment. All other sequential treatments exhibited ≤ 30 percent weed control 8 weeks after initial treatment.

Goals and Outcomes Achieved

One of the chief goals of this project was to investigate response of olive tree flowering to weather/climate. Although progress has been made in this area, more work is needed. Graduate student Staci Parks continues to gather historical weather/climate data from areas of olive production orchards to establish data to assist with prediction of tree phenology. Although historical data will assist in this area, researchers need to continue to work with producers to learn timing of phenological events in each orchard. Additional data will be collected this upcoming spring (2013). To assist with correlation of phenological events and climate, weather stations have been set up in three orchards (Texas Olive Ranch (Carrizo Springs), Farrell's Olive Orchard (Artesia Wells), and Central Texas Olive Ranch (Walburg)). On site weather data will allow for better correlation of phenological events with local weather/climates.

A second goal of the research project was to investigate the physiological response of established olive trees to various irrigation regimes. Most goals were achieved in this area. Field grown trees in two orchards were subjected to three irrigation regimes. Data indicates trees exposed to low irrigation rates often compared favorably with trees exposed to medium and high irrigation rates. However, differences were based upon orchard location. Additional research this upcoming growing season (2013) will give attention to fruit quality as affected by irrigation rate.

Mycorrhizal data appears promising. Data indicates mycorrhizae to be present in roots from olive trees grown in the Conly Orchard, and work is ongoing to determine presence of mycorrhizae from trees grown at Texas Olive Ranch. Research investigating how of the presence mycorrhizae influence enables olive trees to withstand drought will be conducted after cloning of collected mycorrhizal samples is completed (currently ongoing). This is a fairly elaborate and laborious process but researchers expect to have sequences from clones by end of 2012.

Several pre and post emergent herbicides and mulch reduced weed competition. Data from two years of herbicide research indicates a number of herbicides and organic mulch reduces competition from weeds. However, many of the pre and post emergent chemistries used are

currently not labeled for use in olive production. Until label restrictions change, recommendations of herbicides to producers will be limited.

Beneficiaries

Data from the research gives current producers information which will allow them to make decisions to maintain or increase productivity, while reducing costs (energy), and saving a precious natural resource (water). Future growers will benefit by having greater knowledge of olive varieties which may be best suited for Texas climates and weather. In addition, future growers will have greater knowledge of irrigation requirements, soil management techniques to improve production, and weed control options of orchard trees. This will assist in planning and installing irrigation systems in new orchards.

Over the past year this research has been presented at two Texas olive producer meetings. Current producers, and those interested in becoming olive producers attended a meeting sponsored by the Texas Olive Oil Council, in February 2012 with more than 30 people were present at the meeting. Dr. Montague and Dr. McKenney also presented research findings at The Texas Olive Oil Conference held in late August 2012. More than 200 current and potential producers not only from Texas, but from locations across the United States were in attendance.

Lessons Learned: Staff will continue to experience the difficulty of managing projects from a distance of several hundred miles (Lubbock to Asherton, Carrizo Springs, or Walburg, Texas). Cultural management practices (irrigation, pruning, etc.) will need to be better coordinated between producers and the Texas Tech team. Data collection at a distance is difficult and time consuming. It would have been better to collect data more frequently (weekly or bi-weekly) during the experiment. However, because of distance/finances this was not possible. Therefore, staff is taking the best approach and collecting data on a monthly basis. Also, because of time and distance the olive orchard in Walburg was eliminated from the monthly data collection routine. In addition, because olive fruit has never been harvested from experimental trees at the Conly Orchard, staff excluded this orchard from the research. Project staff moved the second experimental orchard from Asherton, Texas to an orchard in Artesia Wells, Texas, because in previous years this orchard has been well maintained, and had reliable fruit production.

Receiving collected data from growers has been a challenge. Producers have little free time, and relying on them to gather phenologcial data (flower, fruit set, etc.) has been difficult. During the upcoming year researchers plan to diligently work with growers to address these concerns, present the data, discuss grower concerns, and solicit help for additional data collection at various orchards throughout the State.

Additional Information

http://texasoliveoilcouncil.org/cultivation.html

PROJECT 3: USING CONSUMER AND FLORAL WORKFORCE EDUCATION TO GROW THE FLORAL INDUSTRY

Partner Organization: Texas State Florists' Association
Project Manager: Dianna Nordman
Contact Information: txsfa@sbcglobal.net
Type of Report: Final
Date Submitted: December 2013

Project Summary
One of the biggest needs facing the Floral Industry is the continued need for skilled floral designers. The Texas State Florists' Association (TSFA) has been working to address this issue by training high school agriculture teachers in floral design. By earning a Texas Master Florist Certification, teachers will be able to teach floral design to high school students and allow students to test and become High School Floral Design Certified. The Texas Education Agency (TEA) has included floral design classes in the Fine Arts Credit. With this addition by TEA, TSFA has seen a greater interest by the agriculture teachers in obtaining the hands-on skills needed to teach floral design.

TSFA and national floral industry leaders have also seen a decline in plants and flowers at funerals and memorial services, primarily with the phrase of "in lieu of flowers" printed by the funeral directors in obituaries. Plants and flowers are a thoughtful and a traditional way to honor a beautiful life. Studies conducted by the Society of American Florists indicate flowers and plants aid in the grieving process. Experts say that although the initial outpouring of sympathy is a great comfort to a family that has lost a loved one, many people experiencing such a loss appreciate being thought of in the weeks and months after the funeral. TSFA would like to promote the importance those plants and flowers make to a grieving family.

Project Approach
Teacher Floral Certification: TSFA awarded the funds available within this grant through a scholarship process to 30 Texas floral design high school teachers for hands on floral training to earn the Texas Master Florist Certification. Teachers with less than three years' experience were provided hands on training in basic floral design, allowing them to teach floral design to high school students across Texas.

- TSFA taught four training sessions for new floral design teachers in 2013, with a series of classes held in March, June, August and October, 2013.
- TSFA taught 12 Texas Certified Florist courses in June 2012 and June 2013 to those teachers that had over three years floral design experience and passed an entry Texas Certified Florist Qualifying Exam.

An unexpected outcome from this training is the extensive, positive working relationship that TSFA has been able to cultivate with the Texas Education Agency. the Vocational Agriculture Teacher Association has seen the value of TSFA's education with both the high school teachers and the students enrolled in floral design and has allowed TSFA booth space at the summer conference at no charge to provide information on teacher floral design

certification, student Level 1 floral design certification and overall floral education. TSFA instructors and Texas Master Florists worked the booth sharing valuable information. TSFA Instructor, Pat Shirley Becker, also presented two floral design workshops to 240 agriculture floral design teachers at the conference.

Student Floral Certification: Five testing sites (El Paso, Pittsburg, College Station, San Antonio and Dallas) have been administered for the 2013 Testing. More than 600 students were expected to sit for the Level 1 (high school) floral design certification. The goal was exceeded by over 100 students, with a total of 727 registering for the Level 1 Floral Design Certification testing.

Sympathy Tributes "in lieu of flowers": The Texas State Florist' Association has seen a decline in flowers and plants sent to traditional funeral services and memorial services due to the "in lieu of flowers' phrase being used. Working with the Texas Funeral Directors, TSFA shared the floral industry concern which is vital to the success of the traditional retail florist. Flowers and plants remind family and friends to celebrate the life lived. The absence of flowers and plants at funerals may have a negative impact on those grieving. The "Celebrate Life" sympathy video was created, distributed through social media, print publications (TSFA's monthly publication *Bloomin' Texan, The Allied Florists of Houston*, Society of American Florists weekly e-Brief, Florist Buying Club's weekly e-newsletter and Texas Funeral Directors monthly publication *The Director*) and discussed one-on-one with interested persons during events. The video was played on a loop during the TSFA Convention & Trade Show in July 2013 and the Texas Funeral Directors Convention in June 2013. The availability of the video was published in the February and March 2013 issues of "the Bloomin' Texan". TSFA retail florists have uploaded the video to their retail websites showing the consumer the importance of ordering Texas grown plants and flowers during the grieving state. The video is currently on TexasLocalFlorist.com and TSFA's You Tube Channel, "Texas Local Florists".

TSFA presented two design program slots at the Texas Funeral Directors Convention, June 2013, to promote the elimination of the "in lieu of flowers" phrase and express the positive impact flowers and plants have on the grieving process. The funeral directors in attendance completed a critique of the program. Comments were positive and the point made that they did not even consider the alternative phrases when creating obituaries for their clients. Print coverage of the design program held at the Funeral Directors Convention will be published in the November issue of the *Bloomin' Texan.* The design program was an additional positive outcome to the video.

TSFA's marketing firm contracted with the Texas Funeral Directors Association (TFDA) to publish monthly print ads in their publication from Feb-Dec. 2013. Ads have run in the TFDA publication in February – October 2013. The ads shared alternative phrases that the funeral directors may use in obituaries like "Flowers and plants are welcome, contributions may be sent to": or "As an expression of sympathy donations may be made to…," leaving out the "in lieu of flowers" phrase completely.

Goals and Outcomes Achieved
TSFA estimated that over 100 additional teachers would participate in the two year training opportunities. Seventeen high school teachers earned the Texas Master Florist Designation with an additional 513 teachers attending the hands on classes with the Texas State Florists' Association or the Vocational Agriculture Teachers Association design classes. TSFA is proud of the accomplishment and believe that a good base of educational resources has been provided to the floral design teachers in Texas.

For the student floral certifications the target was a minimum 25 percent increase in the number of students obtaining the Level 1 Floral Design Certification through additional resources (hands on floral classes and design PowerPoints) being made available to floral design teachers. There were just over 500 students that tested for the Level 1 Floral Design Certification in 2011. The 2013 Level 1 Floral Design Certification results were 774 students, a 40 percent increase.

There had not been a sales benchmark determined when the initial grant report was approved. The Texas State Florists' Association has surveyed florist to determine their sympathy sales increase or decrease over the previous year.

- Dallas area florists surveyed indicated an average increase in funeral sales of 7.19 percent over the previous year.
- Austin area florists surveyed indicated an average increase in funeral sales of 6.00 percent over the previous year.
- Houston area florists surveyed indicated an average increase in funeral sales of 12 percent over the previous year.

Beneficiaries
It is exciting to list those that have benefited from this component of the grant.
- High school floral design teachers and students
- Retail Floral Shops- there are already success stories of retail florists hiring Level 1 Floral Design Certified Florists.
- The state of Texas has roughly 40 wholesalers that will benefit by the additional flowers and plants being purchased by the school districts that are teaching floral design across the state of Texas
- Consumers will receive a correctly designed arrangement and Texas grown plant that has been properly cared for.
- Texas students are now able to attend TSFA's school of floral design in Austin, Texas which was opened to meet the overwhelming demand of floral design education. The first official classes start in January 2014. http://www.tsfa.org/school.html

Lessons Learned
Be prepared for more than your expected projections, just in case! With this project, TSFA needed to increase the number of members qualified to teach floral design and grade the Level 1 Floral Certification hands on component.

Additional Information

TSFA has created a monthly e-newsletter that is distributed to the high school floral design teachers providing design resources, information on where to purchase flowers and Texas grown plants along with design techniques, information on floral classes and Level 1 testing.

Another amazing outcome was the passage of Texas House Bill 5-High School Graduation Requirements in 2013, including courses directly related to fine arts, which the "Principles and Elements of Floral Design" is included along with an industry certification graduation plan. This grant has allowed the Texas State Florists Association to prepare high school teachers and students to be ready for this new graduation option.

The interaction between TSFA and the floral design teachers has been very positive. TSFA and the floral design teachers of Texas are preparing educated students that will either own or work in a flower shop and, just as importantly, have an appreciation of Texas grown plants and flowers.

The "Celebrating Life" video has been shared with the National Alliance of Floral Associations. Many other state floral associations are considering developing a plan to work with their state's funeral directors.

PROJECT 4: DEVELOPMENT OF A PEST-SPECIFIC MONITORING TOOL FOR POTATO PSYLLID, THE VECTOR OF "ZEBRA CHIP" DISEASE OF POTATOES

Partner Organization: Texas A&M AgriLife Research - Weslaco
Project Manager: Dr. Don Henne
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Type of Report: Final
Date Submitted: December 2013

Project Summary

The goals of this project were to identify and test volatile sex attractants for monitoring potato psyllids, which vector the pathogen causing "zebra-chip" disease of potatoes in Texas and other States and countries. Currently available monitoring tools are thought to be ineffective at detecting early infestations of potato psyllids that require grower attention. Completion of this project was expected to provide a new and more effective tool for monitoring potato psyllids in potatoes and other crops that are damaged by potato psyllids (i.e. tomatoes, peppers). This project was performed in cooperation with scientists at USDA-ARS, Wapato, Washington and University of California, Riverside, California.

Project Approach

Laboratory tests were first conducted at Wapato, Washington to assess attractiveness of several targeted chemicals, optimized promising compounds or mixtures of compounds were developed at Riverside, California, and then field tests were performed to quantitatively compare effectiveness of the optimized attractant versus currently available monitoring tools (sweep nets and sticky cards). First, targeted compounds were assayed at Wapato, Washington. Next field assays were performed at Weslaco to test the most promising compounds. Field trials were performed in south Texas, where the potato psyllid overwinters and breeds, before migrating north. To accomplish this objective, two research plots, each 1/3 of an acre were planted to potatoes (cv. 'Atlantic) at the Texas AgriLife Research experiment station in Weslaco, Texas during early January 2012 and January 2013. These plots were drip-irrigated. From mid-February to late March, five separate trials were performed in 2012 and two in 2013 whereby 40-50 pheromone traps were deployed in each plot. Traps were left in the field for approximately one week, collected, and then shipped to Wapato, Washington for analysis and dissections to determine sexes, physiological and morphological conditions of psyllid adults.

Goals and Outcomes Achieved

Very few psyllids were captured on pheromone traps in either season, and much less than were captured on yellow sticky traps (almost 50 to 1). One reason may have been poor trapping conditions (i.e. high winds which contaminated the traps with dust). However, it was recently discovered that the potato psyllid is actually comprised of several genetically distinct populations (haplotypes). There are at least four known potato psyllid haplotypes; central (which includes populations found in Texas), western, northwestern, and southwestern. Some of these haplotypes may have unique pheromone blends, which would make development of a generic pheromone attractant improbable. Preliminary results indicate that potato psyllid females in the Lower Rio Grande Valley of Texas undergo

pronounced physiological and morphological changes during the course of the breeding season, shifting from a breeding phase to a migratory phase. The potato psyllid has been suspected of migrating, but this is the first evidence of this occurring in resident psyllid populations. Morphological changes in reproductive structures are very useful for understanding psyllid migration behavior, and can be critical for predicting when populations are preparing to migrate.

Beneficiaries

This project benefitted several (5-10) researchers who study potato psyllid biology and ecology, and they are actively pursuing development of population-specific pheromones, better pheromone volatility, and testing other attractants such as plant volatiles. Over 1 million acres of potatoes are harvested annually by U.S. growers, with a crop value exceeding $3.7 billion.

The specialty crop (potato) industry will benefit from this project as it highlights the limitations to developing a potato psyllid pheromone monitoring tool, but also presents opportunities for further testing with other chemistries. These results were shared with approximately 20+ growers at the annual zebra chip conference held in San Antonio in November 2013.

Lessons Learned

Although project staff were not able to develop a pheromone tool for monitoring potato psyllids, at least at this time, they were able to learn a great deal about potato psyllid behavior, population structure, and trapping methods that will likely enable us to resolve these problems by pursuing different directions. It was learned that potato psyllid sex pheromone molecules are 'heavy', meaning that the volatility and therefore range of a pheromone trap is rather limited (in contrast to moth pheromones which can travel for several miles). At this time, yellow sticky traps will continue to provide the best way of detecting incipient populations of potato psyllids. It is anticipated that pheromone or volatile traps will eventually complement yellow sticky traps as potato psyllid monitoring tools: yellow sticky traps for monitoring incoming population activity, and pheromone traps to monitor within-field activity.

Additional Information

None to report.

PROJECT 5: SPECIALTY CROP PROMOTION PILOT - A PROJECT TO DESIGN, IMPLEMENT AND EVALUATE A MODEL PROGRAM TO INCREASE SALES OF SPECIALTY CROPS TO WIC AND SNAP CLIENTS AT FARMERS' MARKETS

Name of Organization: Sustainable Food Center
Project Manager: Suzanne Santos
Contact Information: suzanne@sustainablefoodcenter.org
Type of Report: Final
Date Submitted: December 2013

Project Summary

The Sustainable Food Center (SFC) Specialty Crop Promotion Pilot was developed to increase the sale of specialty crops (fruits and vegetables) to low-income families in northeast Austin. The specific strategy used was doubling the dollar value of Supplemental Nutrition Assistance Program (SNAP) and Women, Infant and Children (WIC) benefits and Farmers' Market Nutrition Program (FMNP) vouchers utilized to purchase specialty crops at participating farmers' markets. SFC also sought to create a replicable model to increase the sale of specialty crops to low-income families at Farmers' Markets community-wide.

Because SFC is focused on hunger/food insecurity and obesity prevention, their program primarily targets families, neighborhoods and schools within the most economically disadvantaged zip codes of Austin. SFC also serves the more than 50 farmers that make up the majority of the vendors in the SFC Farmers' Market system. The Double Dollar Incentive Program proved to address both needs: 1) Raise consumption of more fruits and vegetables to begin the trend to address diet related disease; and 2) Keep small local family farms viable by increasing the competitive sales in fruits and vegetables.

The Center for Disease Control confirms there is a high correlation of diet-related illnesses and poverty (http://www.cdc.gov/chronicdisease/states/pdf/texas.pdf), and recommends that communities "improve availability of mechanisms for purchasing foods from farms." Studies also strongly demonstrate that the consumption of nutritious food, such as fresh fruits and vegetables, can improve academic performance in children and reduce the incidence of diet-related diseases by half.

Project Approach

The Double Dollar Incentive Program (DDIP) pilot began in March 2012 (after several months of site/program research and planning) utilizing grant funds from the 2011 Specialty Crop Block Grant (SCBG). The 2011 SCBG allowed SFC staff to operate for a full year to create and write manuals, and fully implement the project to test models of staffing and the processes to stream line this pilot for replication to another site.

SFC conducted considerable research into best-practices for program design. The SFC Farmers' Market Director conducted phone calls, made email requests, attended webinars and workshops, and read reports on the functions of the operations for a DDIP based on the Wholesome Wave model and SFC's previous tracking system for SNAP purchases.

Following the research period, SFC market staff developed a manual for on-site operations, staff and farmer training, client interactions and administrative functions.

SFC met with 12 specialty crop farmers in the fall of 2011 to discuss the opening of a new farmers' market in March 2012, which would be the site of the DDIP pilot program. SFC Farmers' Market Director facilitated a farmer-input session, potential customer focus groups, and an intensive site assessment as a means of determining the best day and the location of the new market.

Following the determination of location, day, time and initial outreach efforts through our network of community partners, farmers received training on the many aspects of the DDIP exchange system. Training included details on the types of scrip (WIC, SNAP, DDIP), the significance of each of these scrip types, customer interaction standards, redemption processes, and tracking requirements. In order to support the training, the SFC Farmers' Market Director, the DDIP coordinator, the SFC Farmers' Market East Coordinator, and Information Booth Volunteers conducted role playing with the farmers to prepare them for participating in the program and understanding how to sell their specialty crops competitively. The new SFC Farmers' Market East featuring the DDIP pilot opened on March 20, 2012. Additional training and monitoring continued on market day as the Market Director and the Market Coordinator reviewed the steps again with the farmers of specialty crops and posted DDIP steps written on signs for the public and consumers.

A strong operational and programming team designed a quick and efficient process to access DDIP benefits, and maintained a consistently high quality market with ample volume and variety of specialty crops for the clients, many of whom had not experienced a farmers' market before, and who certainly had never used DDIP before. The operations of the market implementation on market day consisted of two hours of set up, four hours of running the market, then two hours of break down. The market manager was on site at all times for market operations, trouble shooting on machines used by farmers, collecting scrip for reimbursement, setting up layout each week, generally making clients and shoppers feel welcome to be in the market. There was also a bilingual DDIP coordinator, who provided the explanations to clients and who ran the SNAP, Texas WIC EBT and FMNP doubling process, which included data entry and also using a central SNAP machine. SFC designed a tracking system for the SNAP, Texas WIC, and FMNP benefits spent to measure that the process worked, so it would increase the competitiveness of specialty crops. Specialty crop purchases and the corresponding Double Dollar Incentive dollars were tracked via a token and scrip system. Project staff has used a token system for SNAP purchases at SFC markets for over four years and the farmers and other vendors were already trained on how to accept the tokens for other SNAP eligible products like milk, eggs, etc. SFC separated the SNAP benefits for fruits and vegetable buys from the other SNAP-eligible, non fruit and vegetable purchases in the following manner:
Step 1: A customer approaches the central information booth to use a SNAP card.
Step 2: The market coordinator asks the customer the following questions: "How much would you like to purchase today from your SNAP card for fruits and vegetables, knowing that you will get a 'match' for those fruit and vegetable purchases with double dollars in a one for one match up to $10? Would you like to get tokens for any eligible, non-

fruit/vegetable SNAP purchases such as eggs, bread or honey, which are not matched with double dollars?"

Step 3: The customer tells the coordinator they want to take $10 from their SNAP account for fruits and vegetables and $10 for non-matched eligible items. (This is just a sample, it has been a number of different variables each time).

Step 4: The market coordinator swipes the card and processes a $20 transaction.

Step 5: The market coordinator indicates the following on the $20 SFC receipt of the transaction: $10 in TOKEN amount for non-matched, eligible items (non-fruit and vegetable), and $10 in Double Dollar matched eligible items. The customer will receive $10 in scrip to signify the withdrawal from their SNAP account, which indicates that it can only be used for fruits and vegetables. The customer will also receive $10 in scrip for the 'doubling' of their $10 SNAP purchase in fruits and vegetables. The total in scrip the customer receives is 20 $1 SNAP Double Dollars that can only be used to buy fruits and vegetables. The customer will also receive $10 in market tokens for the non-matched portion of the transaction.

Step 6: The coordinator asks the client for their first name and if this is their first visit to the market. They also ask them for the last group of four digits on their SNAP card. The coordinator then records this information immediately on the laptop computer at the market.

Step 7: The coordinator then records on the laptop the amount of non-matching SNAP tokens that the client receives, the amount of scrip that the client receives, and the matching amount of scrip double dollars that the client receives – exactly one to one – for the fruit and vegetable portion of the SNAP purchase.

Step 8: The coordinator then gives the client their tokens and scrip, and ensures that the customer understands the difference between the two forms of payment before they leave the central information booth. All farmers and vendors at the market understand what these forms of payment can be used for, which is how the spending is controlled once the customer leaves the booth to shop.

In addition, the Sustainable Food Center (SFC) was one of the 501 (c) (3) entities that contracted with the Texas Department of Agriculture to issue and administer the Farmers Market Nutrition Program (FMNP) in the Austin area. All entities in other cities in Texas in the limited FMNP program were food bank organizations working with area farmers' markets. In this case, SFC was the entity contracted for distributing the FMNP in voucher booklets, one booklet per eligible client in which the booklet held 5 $4 vouchers that had to be signed by the mother (or a proxy) at the time of the purchase at the farmers' stand. SFC was contracted by TDA to distribute and regulate the use of these booklets, as well as being the organization that also ran the farmers' markets willing to accept the FMNP in the Austin area. This put SFC in a unique situation to distribute the vouchers designated for Women, Infant and Children (WIC) eligible clients right at the farmers' markets, where the clients would then be immediately able to purchase the fruits and vegetables from the farmers. The FMNP program specifically limits purchases to only fruits and vegetables at participating farmers' market associations. The issuance of the voucher booklets was conducted by an entirely different staff person hired for the season through another source of funding. The location of the farmers' markets as the distribution point was an added incentive for WIC clients to come to the markets in the first place, and because SFC already had the staffing for the DDIP program, and the funding (from private foundations) for the matching dollars, SFC

instituted doubling of purchases on the FMNP purchases as well, tying in the traceability of the fruit and vegetable purchase with a receipt that was written by the farmer, that was then brought back to the information booth for the DDIP coordinator to record the receipt of the FMNP purchase total. Data was then entered for the amount of the purchase, and the amount of the matching scrip (marked as FMNP scrip double dollars only) that was issued. The farmer kept the vouchers that they had received from the FMNP client, and then turned them in according to prescribed processes for the voucher system.

A growth spurt in WIC customers became apparent at the East market location, and also at another SFC Farmers' Market in the southern part of the city (SFC Farmers' Market at Sunset Valley) under this new system of distributing FMNP booklets. Staff evaluated the potential population base, the ability to staff another market with DDIP operations, talked with the funding foundation program officer about an additional site for matching dollars, and refined training materials so that a second market was added to replicate the DDIP.

Wholesome Wave instructed the market staff on data collection and reporting. Staff collected data on a laptop at the market from each exchange with customers who bought specialty crops, and, then the data was transferred to a systemized excel sheet to make quarterly and yearly reports. In addition, SFC staff was trained to enter in data for a nation-wide compilation of data among Double Value Coupon Program partners who received funding from Wholesome Wave, and this data resulted in a report for 2012 activity across the country. SFC also formed a partnership with Wholesome Wave's national evaluator and a University of Texas graduate student from the school of public health to conduct an in-depth behavior change survey of 20 respondents that included surveys during the market, then a follow up survey by phone. The main questions of the study were to assess the impact of the DDIP as a health promotion strategy on healthy eating and barriers or facilitators to fruit and vegetable intake. There was a 7 percent increase from pre and post measurements in the amount of fruits and vegetables participants reported on their dinner plate in the SFC Farmers' Market East sample, compared to a 1 percent increase in the San Antonio Sample (where DDIP does not exist). About two times the percentage of the post SFC East sample (55%) reported shopping at the farmers market "often or always" compared to the baseline sample. In addition, a team of community organizers, the on-site coordinator, the director, and volunteers conducted a snapshot survey of all customers who came to the market in one day in June. The team surveyed 106 customers, of which 53 were in the DDIP. Of these customers, 67% use SNAP, 12% use FMNP vouchers, and 45% use WIC EBT cards with a fruit and vegetable amount. When they were asked how important the DDIP was to them, this is how shoppers reported: Very important (would not come without it) -69%; Moderately important -24%; Slightly important -6%; Not important- 2%.

Goals and Outcomes Achieved

The first several months of this grant was a very slow period for sales. The concept of Double Dollar Incentive Program, even with separate dedicated funding from the USDA's Farmers Market Promotion Program to spread the message far and wide and in culturally appropriate channels, was a concept that was hard to grasp until the shopper showed up at the market. The period from March through July was slow, but then started picking up in July, as we introduced the FMNP and the markets became the pick-up sites. While the customers in

the summertime surveys were more than satisfied with the market and the farmers' offerings, the customers dropped off after the expiration date for using FMNP vouchers (September 30 each year). During the course of reviewing data, the customer surveys, the vendors, and partners' input from September to December, it was decided to move the market to a more dense area of Austin, and a few miles back into the urban core. Just in the first week (March 5, 2013) at the new location on East MLK, Jr. Boulevard, sales increased from $250 that occurred in the last week in February to over $2,000 in the very next week.

The goals of the project were to increase the sale of specialty crops in northeast Austin in the amount of $100,000. SFC did accomplish, from March 20, 2011 through March 30, 2012, to increase sales never before realized, because the market had not existed. This program of DDIP was specifically implemented to increase the competitiveness of the farmers' fruits and vegetable sales (specialty crops), so that they could sell more fruits and vegetables specifically tied in with an incentive program that attracted new customers that could become steady buyers. These are estimates given by the farmers on their fruit and vegetable sales. While we did not achieve a total of the estimated $100,000 additional sales of their crops, the farmers participating in the DDIP did sell $70,640 in specialty crops at the two DDIP markets. The $70,640 is a compilation of the weekly sales figures that the fruit and vegetable farmers give us at the end of market, which includes the $32,370 subset of DDIP scrip that was issued and used to purchase fruits and vegetables from the farmer (and then turned in by the farmer for reimbursement) during the first year's period, April 2012 – March, 2013.

SFC collection of data for the farmers' sales was done at the end of each market day. They compiled that sales data in periodic (quarterly) and annual reports. We had no previous sales numbers to refer back to for the farmers' sales at the SFC Farmers' Market East because that market had not existed before. The farmers self-reported that they had an increase in sales (as a direct result of the Double Dollar Incentive Program and the opening of this market) because that was the first year of this additional market with this special program, on top of the markets that the farmers were already going to.

There were more than 5,642 DDIP shoppers frequenting the two markets during this period April 2012 through March, 2013. Of these shoppers, 996 were unduplicated DDIP clients, indicating that the DDIP clients did repeat visits to the markets. While we did not reach our anticipated goal of 1,500 unique individuals, we did reach almost 1,000 who became repeat customers.

The model became replicable (one of the goals) by the end of five months of operating the East market (preceded by five months of planning), and staff started processing DDIP at the SFC Farmers' Market at Sunset Valley in August, of 2012.

The objectives were to train eight specialty crop growers to participate in the northeast Austin project; staff completed the year with training up to eight at the East market, but also training up to 12 at the Sunset Valley market. While this grant proposed farmers would sell $100,000 of fruits and vegetables, only $70,640 was sold at the East market. SFC reached 996 unduplicated clients in the April-March period, but also reached an additional 79 unduplicated clients in March during the opening month, for a total of 1,075 at the East

market. All of the participating growers reported an increase in sales, while the objectives were that 80 percent would. Seventy-seven percent of consumers in the DDIP program reported that they did increase their consumption of fresh fruits and vegetables, falling just three percent below the objective.

Beneficiaries

20 local farmers were involved in the Double Dollar program. There were also more than 1,000 Austin families and individuals that benefited from being able to double the value of their purchases so that they could take more fruits and vegetables home to prepare and eat. The extra $70,640 in purchases of fruits and vegetables would not have been possible without this grant and the funding by foundations (St. David's Foundation, Farm Aid, Wholesome Wave) for the matching dollars.

Lessons Learned

Project staff learned that even with an ideal location and site partner (at YMCA) the project needed to be in a more densely populated area, along a bus line and with plenty of parking. They also benefited from incentivizing first-time shoppers to come to the market because that is where WIC moms needed to pick up their vouchers. The incentive of the double dollar worked also with SNAP shoppers, a few hundred that had not ever shopped the farmers' market previously. What SFC still finds as a barrier is that the DDIP is a complex idea to communicate to potential shoppers.

Additional Information

Please see attached report by Rose Jennings.
Please see the following report by the LBJ School of Public Affairs:
http://www.sustainablefoodcenter.org/_files/reports/Farmers_Market_Incentive_Programs_report_LBJ_2013.pdf

PROJECT 6: ENGAGING CONSUMER AND GROWER AWARENESS FOR OLIVES AS A TEXAS SPECIALTY CROP

Partner Organization: Texas Olive Oil Council
Project Manager: Karen Lee, klee@texasolive.com
Type of Report: Final
Date Submitted: December 2012

Project Summary
Olive agriculture has recently been established as a viable crop for Texas. The first commercial crop of Texas was harvested in 2007, and interest from potential growers and investors has escalated then with steady growth in olive orchard installations, as well as increases in crop yields. Since the Texas olive industry is still very young, most Texans are not familiar with the availability, benefits, and experience of fresh olive oil or that they can get Texas-grown olive oil.

The purpose of this project was to bring awareness to consumers and growers for olives as a Texas specialty crop. Growers seeking to plant economically viable crops have had limited resources for learning about the potential of olive oil culture. Consumers interested in purchasing fresh, locally produced foods have had limited access to fresh olive oil flavor profiles and health benefits. This project was planned to provide readily available resources to educate and inform consumers and growers of the facts, availability, success, and benefits of Texas-grown olive oil. The goals were to increase awareness and acceptance of Texas grown olive oil, and to provide grower training and education. The approach was straightforward and all goals have been met within budget. Interest in olives as a specialty crop has been greater than expected, and the consumer awareness efforts have resulted in positive market growth for the industry.

Project Approach
To increase awareness and acceptance of Texas-grown olive oil, the Texas Olive Oil Council (TOOC) planned to develop a website featuring consumer and grower sections, maintain awareness through regular distribution of an electronic newsletter or 'e-zine,' and conduct olive oil demonstrations at farmers markets around the state and on television. To provide grower training and education for olives as a Texas specialty crop, TOOC planned to coordinate an olive growers conference provide the best management practices for olive agriculture in Texas, and create a forum for the development of an olive agriculture community and communication.

TOOC engaged a communications firm to execute the professional tasks identified and accomplished the goals outlined in the proposal.

Develop a new website featuring a consumer area and a grower area.
TOOC retained BAH Design of Austin to develop and launch a new, more interactive and user-friendly website in January 2012: www.texasoliveoilcouncil.org. The new website was launched with a total of 16 new pages built around a consumer category and a grower

category, with the capability of linking to archived materials, news articles, and industry resources. It continues to grow with new pages added on a quarterly basis.

Marketing of the newly designed website consisted of the five following tactics:

- E-zine promotion plus social media development
- Product demonstrations at farmers markets and community events
- Cooking with olive oil demos in cooking classes by Chef Rebecca Rather
- Television demonstrations
- Signage and flyers -- Texas Olive Oil Council / GO TEXAN standing banners

Website marketing commenced immediately upon the launch of the new website with a newly designed e-zine distributed to the Texas Olive Oil Council membership and to an email list comprised of queries to the Texas Olive Oil Council website. A total of 5 e-zines were published including two quarterly e-zines in 2012, two conference promotional e-zines, and one conference recap e-zine. A twitter account was established, along with a Facebook page. TOOC has more than 70 Twitter followers, more than 80 "Likes" on Facebook, and a network of more than 800 professionals on LinkedIn.

Product demonstrations were conducted at 624 events and farmers markets, with an average of 260 sample demos per event (417 gallons over the year). The majority of this product was donated by Texas olive oil producers including Texas Olive Ranch, Central Texas Olive Ranch, Jewett Farms, Farrell's Olive Orchard, and Anderson Ranch. In addition, the TOOC purchased oil from non-contributing Texas olive producers to include in demonstrations so that customers could learn the breadth of Texas olive oil production and availability.

Chef Rebecca Rather performed 16 cooking classes using Texas-grown olive oil at Central Markets in Dallas, Houston, Austin, and San Antonio. In her capacity as a celebrity chef (winner of the James Beard Cookbook Award) she has served as a celebrity judge and demonstrated recipes as a celebrity chef at 23 additional special events and always makes a point of telling the story of Texas olive oil. Chef Rather has created 24 recipes across six seasonal themes.

A documentary film directed and produced by Bill Millet that chronicled the history of the introduction of olive agriculture to Texas around 1930 and showed the growth of olives as a Texas specialty crop was aired on PBS stations in San Antonio, Dallas, Houston, Corpus Christi, Harlingen, and Wichita Falls. These presentations, along with olive oil demos during pledge drive breaks were a great avenue for product awareness. PBS station managers estimate that these presentations reached over 13 million viewers in six regional broadcast markets with repeat broadcastings.

Texas Olive Oil Council created four pull-up screens for increased awareness at demonstrations and events. In addition, approximately 48,000 laser-printed flyers size 5.5"x8.5" were printed and distributed at product demonstration sites over the year.

To complete the second goal of providing grower training and education, TOOC developed an olive oil conference to provide best management information and practices to Texas

growers and potential growers, present research relevant to olive agriculture in Texas, provide guidance for certification programs, and provide a forum for olive growers to share their experiences and information. The first annual Texas Olive Growers Conference was held August 22-24 at the Embassy Suites Hotel on the Riverwalk in San Antonio.

TOOC was able to take advantage of new technology and created a mobile app that allowed conference attendees to download all conference information onto their smart phones. The link to the app was printed on the back of the conference name badges along with a copy of the conference agenda. By scanning the code on the back of the name badge, the app appeared on the users' phone with the full agenda, speaker bios, a local Google map, and a directory to all registered attendees.

The timing of the conference was fortuitous and staff were able to secure highly respected leaders on the national and international stage for olive oil quality and education as well as horticultural practices and management in addition to Texas researchers. Speakers included world experts on olive oil from both a horticultural and a consumer vantage point; Dr. Nasir Malik, USDA (Kika de la Garza Research Station) Research Scientist studying olive vertilization and health benefits; Dr. Cynthia McKenney and Dr. Thayne Montague, Professor of Horticulture at Texas Tech University studying weather effects and water utilization in Texas olive trees; and several representatives from Texas agricultural support agencies and services. Conference materials have been made available for downloading to conference attendees on the Texas Olive Oil Council website at no charge. Non-attendees may purchase copies of conference materials at a nominal fee for downloading. To date, unique conference presentations files have been downloaded 63 times by conference attendees. Two non-attendees have purchased conference materials access and downloaded a combined total of 9 presentations.

Goals and Outcomes Achieved

The two goals of this project were to increase awareness and acceptance of Texas grown olives and olive oil and to provide grower training and education.

Upon launching the new website, unique visitors sharply increased 35 percent and remained high throughout the year for a total result of 565,495 hits in 2012 to date, a 36 percent increase on a month to month basis over 2011. This increase is significantly greater than the 5 percent targeted in the original proposal. Website statistics are from AWSTATS, a statistical analytics package provided by the domain hosting service (Bluehost) and from Google Analytics.

Base on survey results, of the people sampling Texas-grown olive oil for the first time, it is estimated that 80 percent, expressed surprise at the flavor and complexity of the oil and made purchases. Approximately 8 percent of tasters had previously tasted fresh olive oil while traveling in Europe or California and were pleased to know freshly pressed Texas-grown olive oil can now be sourced locally. Approximately 4 percent of people sampling fresh Texas olive oil did not like it, saying it was "too hot," or "too peppery," which is consistent with research conducted by UC Davis in 2009 showing that 33 percent of American olive oil consumers prefer flat or tasteless olive oil.

Texas olive oil producers selling olive oil via wholesale distribution, retail sales, online sales, and farmers markets (combined) estimated 2012 sales increased over 2011 sales for the first three quarters by an average of 32 percent. These numbers are self-reported from TOOC member growers.

In regards to TOOC's second goal a post-conference survey was sent to attendees after the Texas Olive Growers Conference to measure before and after knowledge and satisfaction levels with the conference presentations. Overall, attendees said the conference achieved an increase in knowledge levels regarding olive farming in Texas from 37 percent before to 95 percent. Knowledge about olive oil imports and trade practices also showed strong gains increasing from 20 percent pre-conference to 90 percent post-conference.

One third of participants reported having an olive orchard, with a total of 145,000 trees, representing a majority of olive growers in Texas. Of the remaining two thirds of attendees, 45 said they expected to plant olive trees in the near future. Of those, half expected to plant more than 6,000 trees.

Attendance was greater than expected, with 288 people.

Beneficiaries

Seventy existing olive growers attended the conference and 140 potential olive growers or investors benefitted directly from the training. In addition, over 60,000 olive oil consumers benefitted from the product demonstrations conducted across Texas at farmers' markets, and approximately 3 million viewers benefitted from the demonstrations seen on Texas public television stations.

The Texas olive industry is the primary beneficiary of this project, having made significant progress toward accelerating awareness and acceptance of Texas grown olive oil over the grant period, as well as creating interest in additional crop development among existing and potential olive growers.

Texas Olive Oil Council members and conference attendees have reported a total of approximately 1,000 acres currently in olive cultivation for purposes of processing high quality extra virgin olive oil, statewide. This figure does not include data for growers planting less than ten acres.

Lessons Learned

TOOC learned the demand for the information was much higher than estimated. Tools built through this grant will assist the organization to satisfy ongoing interest levels.

TOOC may consider conducting two, one day meetings, rather than one two-day meeting. Attendees may have experienced information overload on day one and the material presented the second day was less enthusiastically received. By shifting the schedule or presentation medium better results may be achieved

Additional Information
TOOC website: http://texasoliveoilcouncil.org/recipes.html

Program Income
Conference admission was set low at $125 per person, and total revenue from registration fees was $12,250.00, 22.5 percent greater than expected. These funds were used to pay for conference costs not covered by the grant program. Remaining funds will be applied to expanding the educational presentations, and reaching out to venues for community organizations such as Rotary Clubs, Garden Clubs, and Lion's Clubs.

PROJECT 7: NEW TOOLS AND STRATEGIES FOR MANAGING THE DEVASTATING TEXAS (COTTON) ROOT ROT DISEASE IN TEXAS WINE GRAPE

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Type of Report: Final
Date Submitted: December 2014

Project Summary

There are many challenges facing the wine and grape industry in Texas. Among the challenges are harsh environmental conditions, diseases and pests. As with any young and growing agricultural enterprise, the list of challenges increases as acreage of the crop expands. This is certainly the case with wine grapes in Texas. Among the diseases being encountered with increasing frequency by vineyard growers is Texas (cotton) root rot (TRR), *Phymatotrichopsis omnivora*. Texas root rot is of particular concern because infections of the grapevine root system can invariably lead to the death of the vine, and there are currently no satisfactory control measures. To compound the problem, there are no good measures of the impact TRR is having on Texas winegrape production because symptoms can be confused with other diseases, such as the widely prevalent Pierce's disease. Field diagnosis of the disease is further complicated by the challenge of detecting the pathogen on the roots of an infected vine. These complications have led to significant frustration for growers as they manage their vineyards for maximum efficiency and productivity. The purpose of this study was to address the critical deficiencies in the understanding of TRR on grapevines by approaching the problem with three goals.

Project Approach

Systematic geographic surveys had not been taken to obtain a definitive distribution of the incidence and severity of TRR in Texas vineyards. The first goal was to create a survey instrument to obtain complete and concise data needed by current and prospective grape growers to help manage the disease. This information provided the first step toward determining the geographic distribution of the disease. Furthermore, it has served as a baseline in determining the impact of our proposed management strategies. The second goal relates to a promising control measure with the potential to offer relief to growers, but there must be further research. Recent field research has shown when the fungicide flutriafol was applied through drench applications in cotton; the impact of the disease was reduced. A similar method could easily be tested in grapevines. A standard screening procedure was developed to artificially inoculate containerized grapevines with the pathogen and compare the outcome of treated vs. untreated grapevines. The same treatments are being analyzed in commercial and experimental vineyards under natural disease pressure.

Finally, the results of the first two goals have been delivered to growers through the development of fact sheets, publications, reports, brochures, and lectures/presentations at industry conferences.

Steps taken:
Secured the 5 acre experimental vineyard and plot design in Leakey, Texas.
Provided crucial experimental design methods of fungicide application and greenhouse experiments. Previous grape research provided a network of possible grape grower cooperation.
Scheduled treatment applications, ordered supplies, arranged visits with the cooperators, and wrote reports.
Visited grower's vineyards, collected data and generated maps of where the disease was present.

Goals and Outcomes Achieved

Goal 1 was to estimate Texas root rot incidence and severity in the Texas winegrape growing regions through the use of a grower survey (See Appendix) and diagnosis of vines submitted to the Texas Plant Disease Diagnostic Laboratory (TPDDL).

- Vine samples were submitted in 2011- 2013 to TPDDL and were tested for TRR. A geographical map was created to illustrate the counties where TRR has been documented on grapes. (See Fig. 1 below)(McBride)
- Commercial vineyards were visited in response to the grower survey and mapped for TRR disease incidence within the vineyards. (McBride, Appel, Lewis)

Survey instruments have provided critical and useful information as to the geographical distribution of the TRR pathogen within the state of Texas. The map has provided information to new and prospective grape growers about the risks of TRR.

Fig 1. Knox, Kerr, Kimble, Hidalgo, Grayson, Travis, Harris, Dallas, Austin, Lavaca, Goliad, Real, Gillespie, Burnet, Washington, Colorado, Victoria counties depicted in green indicated counties where CRR was detected.

Fig. 2 Fungicide application

Goal 2 was to develop control methods to reduce losses of grapevines due to Texas root rot.

- 288 Merlot on 5BB rootstock vines were purchased. They were planted in April 2011 in a randomized block design (8 treatments, 5 vines/plot, 6 reps) (See appendix fig. 1 and 2) and fungicide treatments were applied to the experimental vineyard in Real Co (See appendix Table 1 for list of fungicides applied).

- 200 Sangiovese on SO4 rootstock vines were purchased and over wintered in a greenhouse. They were planted March 2012 in a randomized block design (4 treatments, 5 vines/plot, 5 reps) (See appendix fig. 5 and 6) in the commercial

vineyard in Travis Co. Three different concentrations of the fungicide flutriafol were in applied March 2012. (Fig. 2)

- Fungicides were subsequently applied the following year to both experimental plots. (McBride, Appel, Kamas, Black, Lewis).
    a. Vine disease ratings were collected to ascertain efficacy of fungicides in the commercial vineyard in Travis Co. and the experimental vineyard in Real Co. (McBride, Appel, Lewis) (See appendix fig.3 and 4)
    b. Vine periderm counts were collected and analyzed to determine any growth regulator effect of the fungicide treatments. (Lewis, Kamas)
- Vine disease incidence measures were collected to ascertain possible tolerant rootstocks planted in the experimental vineyard in Real Co. (Black, Kamas, McBride, Appel, Lewis).
- General maintenance of vines included adding nutritional supplements, training of vines, and irrigation. (McBride, Black, Kamas, Lewis, Appel)

Grapevines in the experimental vineyard and the commercial vineyard have been treated with the fungicides and disease ratings have been recorded for future statistical studies showing the efficacy of the fungicides. In addition, rootstock trials in the experimental vineyard have been examined for the presence of the pathogen when there was vine death. Data will be compiled for future recommendations as to what rootstocks work best in the presence of the pathogen. This work is being extended with the SCBGP 1213-036 grant awarded in 2012. Results will be given in final report.

Goal 3 was to distribute results of the project to the Texas winegrape community. The following is a list of the venues in which research efforts and results were presented.

- Fruit and Nut Conference (120 people) presentation sponsored by Texas A&M AgriLife Extension Service "Texas Cotton Root Rot" October 2012. (McBride)
- Presentations at two annual Grape Camps sponsored by the Texas Wine Grape Growers Association, November 7, 2011 "Texas (Cotton) Root Rot of Grape Research Efforts" and, November 4-5, 2012, entitled "Recognizing and Managing Cotton Root Rot (CRR)". Approximately 120 people were in attendance during each meeting. (McBride, Appel)
- Presented a paper at the American Phytopathological Society Southern Division Meeting (75 people) on February 9, 2013, entitled "Field trials for control of *Phymatotrichopsis omnivora* on grapevines in Texas." (McBride)
- Poster presentation at the Texas Congressional Educational Evening (120 people) March 2013 "Cotton Root Rot on Wine Grapes: Past and Present." (Fig. 3 McBride and Appel)

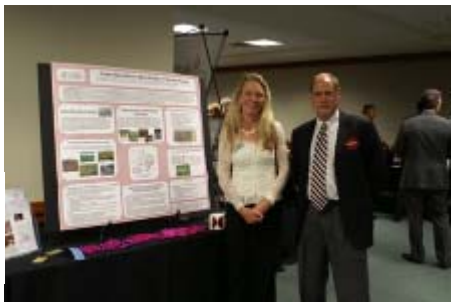


Fig. 3 Poster session at the Texas Congressional Education Evening

- American Phytopathological Society annual meeting. Field trip showcased field trials at the commercial vineyard in Travis Co. August 10, 2013. 50 scientists from around the country in attendance. (See fig 4 below)(McBride, Appel, Black, Kamas, Lewis)

Fig. 4 APS field trip

- Presentations at two Texas Hill Country Grower Field Days – September 27, 2013 and October 25, 2013. Approximately 80 growers at each venue in attendance. (McBride, Appel, Black Kamas, Lewis)

Beneficiaries

- 420 growers covering 4,400 acres and 273 wineries from the Texas Hill Country region have been especially impacted by this devastating disease and have benefited from the research. Others who attended the Grape Camps hosted by the Texas Wine Grape Growers Association were prospective growers, viticulture consultants, and county agents. Project staff was fortunate to be invited to attend the Texas Congressional Educational evening where grape growers, wineries representatives, and congressmen and their staffs were present to view posters providing an understanding of the work being conducted in grape research. Project staff was able to promote awareness of the research being conducted within Texas A&M AgriLife.
- When present, TRR causes significant economic losses on many other specialty crops, such as peanuts, pecans, peaches and apples. Through educational efforts, researchers were able to provide outreach to many of these growers as to the impact of TRR and the current research being conducted in winegrapes.
- With the potential for disease control with fungicide, chemical companies may benefit from growers adopting the practice.
- An estimate of the number of beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project is being projected in conjunction with a subsequent project funded under the 2012 Specialty Crop Block Grant (Project 18: New Tools and Strategies for Managing the Devastating Texas (Cotton) Root Rot Disease in Texas Wine Grape).

Lessons Learned

- This project stimulated new project cooperators with commitments of their time and resources setting up additional experimental plots to continue the objective of trying to control TRR.
- One of the chemical companies has become interested in exploring the possibility of having the fungicide registered for use in grapes.
- Obtaining information on disease occurrence was an unexpected obstacle. Project staff was confronted with some growers who were reluctant to share information pertaining to any problems they may be experiencing in their vineyard.
- As with many young and expanding industries, there can be difficulties in addressing the needs of a large group of stakeholders when there are varying views on priorities needed to advance the agendas of individuals in different grape growing regions in Texas.
- As the grape growers began to become knowledgeable through the educational efforts, project staff was inundated with offers to set up experimental plots in their vineyards. Project staff had to decline expanding the project with these offers due to lack of resources.
- It became apparent growers expected the research to go faster so that they could implement the use of the fungicides. This occasionally led to some level of grower frustration.
- Unforeseen availability of plant material delayed the planting at the experimental commercial vineyard requiring the vines to be overwintered in a greenhouse.
- The unpredictability of the pathogen was greater than anticipated in one of the experimental locations.
- The fungicide application method proved to be practical only on a small scale. When approved, an entirely different application method will be needed.
- There were difficulties in training and retaining technical staff because of the lack of qualified applicants and the short duration of the grant.

Commercial grape growers in Texas express enthusiasm and continue to support this project via personal contact with all the project partners. Two grape growers in particular agreed to host field fungicide trials (Timothy Leach, Real Co. near Leakey (two trials); Rick Naber, Flat Creek Estates & Winery, Travis Co., near Marble Falls, Texas. These commitments consisted of contributions in terms of labor, vineyard infrastructure and general grapevine maintenance. When rabbits chewed on many of the vines in the Leakey experimental vineyard, the cooperator installed an electric fence thus preventing further damage and cost to the experiment.

Additional Information

Vineyard Survey for Texas (Cotton) Root Rot

Vineyard Size

1. How many acres of vines are managed in your vineyard? _____
2. How old are the vines? (If various ages, give a range)_____

Vineyard Site

1. What county is your vineyard located?_____
2. What is the soil pH in your vineyard?_____
3. Do the soils in your vineyard have? (Circle the best fit)
   A. Excellent drainage
   B. Adequate drainage
   C. Poor drainage
   D. Variable drainage types

Presence of Texas (Cotton) Root Rot (TRR) in Vineyard

1. Have you ever observed symptoms in your vineyard such as: **leaf scorch sudden death of vine dried leaves remaining on vine (circle all that apply)**
2. Has TRR ever been implicated/confirmed a problem in your vineyard? **Yes No**
   If yes, how was it diagnosed? (Circle one) **Laboratory Field observation**
3. Do you believe you lost vines in the 2010 growing season due to TRR? (circle) **Yes No**
   If yes, approximately how many vines were lost? _____
4. Would you be interested in a diagnostic confirmation of TRR for your vineyard? **Yes No**

Rootstocks

List the names of the own rooted or scion/rootstock varieties in your vineyard, vines affected by TRR (yes or no) approximate acreage of each.

Scion/Rootstock	Affected by TRR	Acreage	Scion/Rootstock	Affected by TRR	Acreage
	Yes No			Yes No	
	Yes No			Yes No	
	Yes No			Yes No	
	Yes No			Yes No	

Questionnaire completed by: _____**Date Completed**:_____

Vineyard name: _____

Table 1 Fungicides applied in the experimental vineyard in Real Co. TX

Chemical Trade name	Chemical Company	Active Ingredient	Class of Fungicide Mode of action FRAC	Registered for Grapes	Rate per acre	Maximum per year
Topguard®	Chemincva	Flutriafol (11.8%)	Group 3 Sterol inhibitor	NO	16-32 oz 3 oz per 100 gal	28 oz/acre No more than 3 apps/year
Pristine®	BASF	Pyraclostrobin (12.8%) Boscalid (25.2%)	Group 7,11 Carboximide, Strobilurin	YES	6-12.5oz	60oz/acre No more than 5 apps/year
Omega®	Syngenta	Fluazinam (40%)	Group 29	NO	1.25 pints/acre Min 100gal/acre	6 pints
Vanguard®	Syngenta	Cyprodinil (75%)	Group 9 Anilinopyrimidine	YES	10oz/acre 30gal/acre	30oz/acre

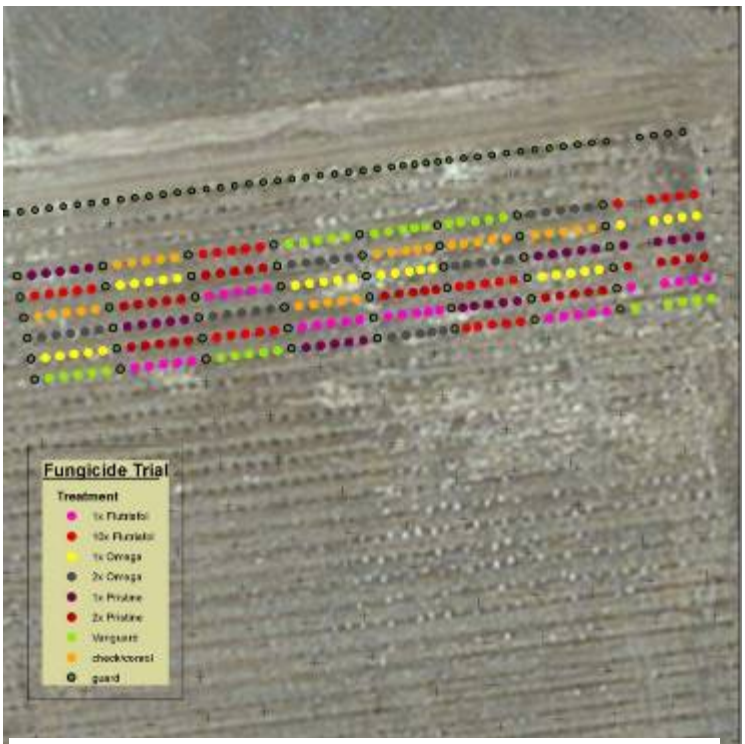
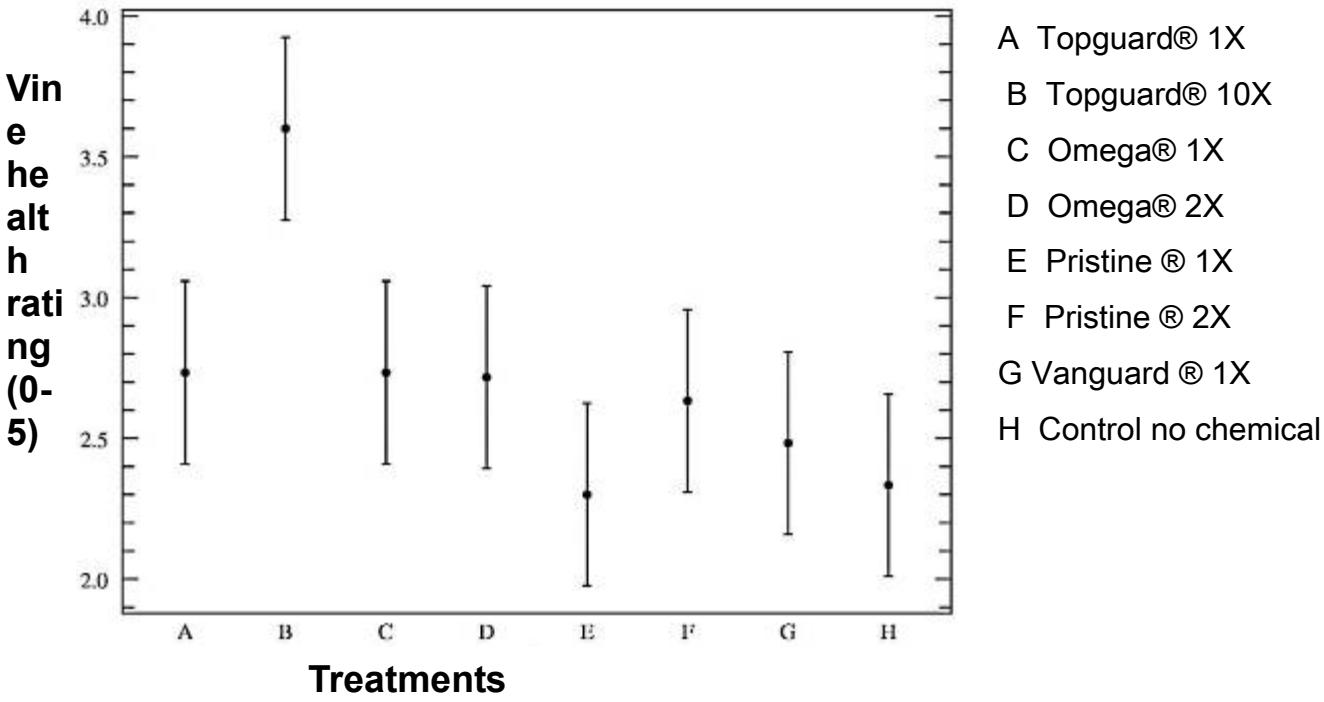


Fig. 1 Randomized Block Design in experimental plot in Real Co.

Fig. 2 Real Co. experimental planting April 2011 with project partners



95% confidence intervals for mean utilizing Analysis of Variance

Fig. 3 Results of vine health

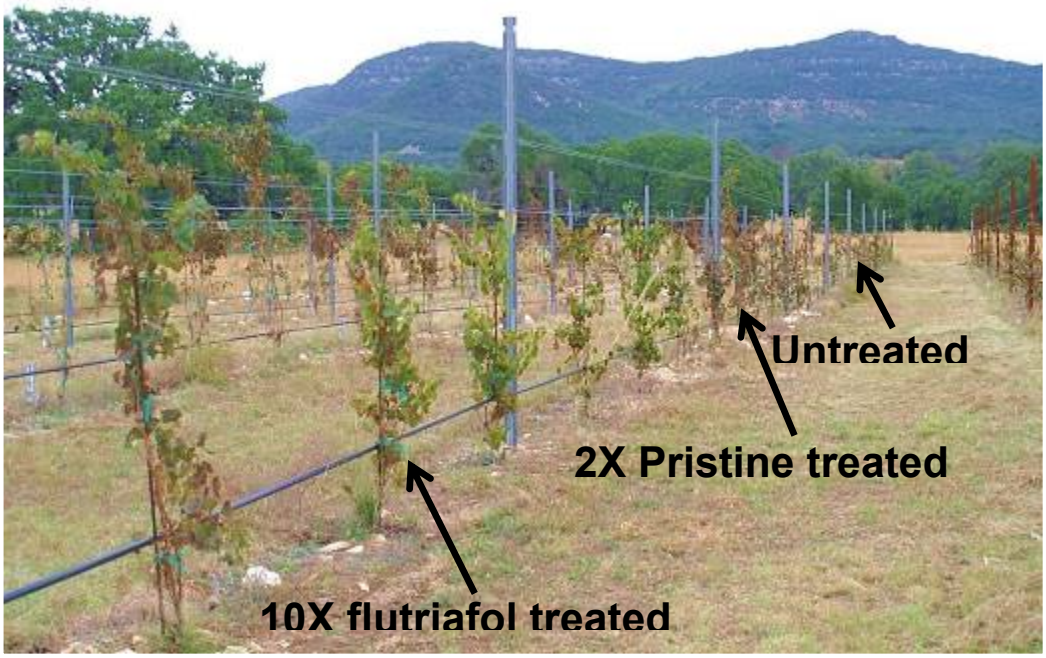


Fig. 4 Visual observation of Real Co. experimental plots November2012

method

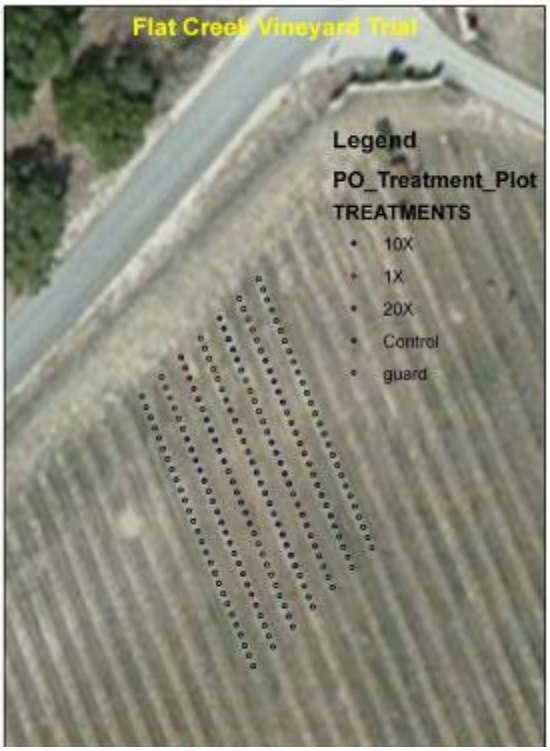


Fig. 5 Randomized Block Design experimental plots at Travis Co commercial experimental vineyard March 2012

PROJECT 8: EVALUATION OF COOL-SEASON AND WARM-SEASON GRASSES FOR SEED PRODUCTION IN WEST TEXAS

Partner Organization: Texas Tech University
Project Manager: Dr. Richard Zartman, (806) 742-1626
Email: richard.zartman@ttu.edu
Type of Report: Final
Date Submitted: December 2012

Project Summary

The Conservation Reserve Program (CRP) was established by the Food Security Act of 1985. This voluntary program was designed to encourage landowners of highly erodible or environmentally sensitive land to remove it from agricultural production. The 2008 Farm Bill approved cuts to the CRP that removed approximately 7 million acres of land from the program nationwide starting October 1, 2009. This has left landowners seeking viable land-use options.

Grass seed production may be a viable and more environmentally friendly alternative to the production of other agricultural crops. Advantages to perennial grasses for seed production include no yearly planting costs, reduced soil erosion (yearly tillage operations are not required after grasses are established), reduced chemical and fertilizer inputs. Grass seed production also spreads the work load more evenly on the farm.

Grass seed production in West Texas could bolster and diversify an already strong agronomic market. The enhancement to the seed production industry would increase employment opportunities throughout Texas. Therefore, the objective of this research was to examine the seed production capabilities of several cool-season and warm-season turfgrass species in West Texas.

Project Approach

The overall objective of this research was to examine seed production capabilities for several cool- and warm-season grass species in West Texas. The specific objectives of the study were to identify optimal harvesting time of four cool- and warm-season grass species. The researcher anticipated having grass stand establishment from the 2010 Specialty Crop Block Grant project. Due to the extremely dry weather, grass stands were not successfully established in 2011, which severely limited the potential to harvest seed in 2012.

Grass seed for this project was planted immediately above subsurface drip irrigation tape in beds in 2012.

Cool-season grasses planted:
Tall Fescue - [*Schedonorus phoenix* (Scop.) Holub] ('Tar Heel II')
Creeping Bentgrass - (*Agrostis stolonifera* L.) ('Seaside II')
Perennial Ryegrass - (*Lolium perenne* L.) ('Charger II')
Annual Ryegrass - (*Lolium multiflorum* Lam.) ('Panterra')
Kentucky Bluegrass – (*Poa pratensis* L.) ('Merit')

Warm-season grasses planted:
Bermudagrass - [*Cynodon dactylon* (L.) Pers.] ('Riviera')
Seashore Paspalum - (*Paspalum vaginatum* Swartz) ('Sea Spray')
Buffalograss - [*Bouteloua dactyloides* (Nutt.) J.T. Columbus] ('Cody')

Immediately after seeding, a torrential rainstorm occurred and washed away the seed. Seeds were replanted but seedling stands could not be reestablished successfully.

Goals and Outcomes Achieved
Cool-season grasses (tall fescue, creeping bentgrass, perennial ryegrass, and annual ryegrass) and warm-season grasses (common bermudagrass, seashore paspalum and buffalograss) were row planted in 2012 at the Quaker Research Farm in Lubbock, Texas. Immediately following planting, a large rainfall event washed out the grass seeds. Replanting was not successful in reestablishing stands. Without successful stand establishment, no seed were available for harvest. Cool-season and warm-season grass species that successfully produce seed could not be identified.

Beneficiaries
This research was geared to provide landowners and farmers with more lucrative and environmentally benign option for agronomic production in West Texas. The enhancement to the seed production industry would also increase employment opportunities throughout Texas. Overall, the production of a perennial grass seed crop would benefit the economy, community and environment of West Texas. Although no seed was produced in this study, this can be attributed to the lack of establishment and maturation. Seed production may be possible once grass stands are successfully established. Staff was unsuccessful in harvesting either warm- or cool-season grass seed in this study.

Lessons Learned
Establishment of grass seedling stands using traditional clean-tilled bed and furrow was unsuccessful. Environmental conditions have not been conducive to grass establishment due to extreme drought (2011) bad rainfall events (2012). Management practices need to be altered from row crop production to more of a drilled production system.

PROJECT 9: EATING TEXAS VEGETABLES AT HOME CAMPAIGN

Name of Organization: Texas Vegetable Association
Project Manager: J Allen Carnes
E-mail: jcarnes@wintergardenproduce.com
Type of Report: Final
Date Submitted: January 2013

Project Summary

The Texas Vegetable Association's (TVA) *Eating Texas Vegetables at Home Educational Campaign* project for 2012 took a different approach to reaching consumers. Instead of working with a chef to market vegetable recipes to adults only, the 2012 campaign reached out to the families by emphasizing the importance of healthy eating through a television marketing campaign and online advertising in select Texas markets. The goal of this campaign was to increase awareness of the greater desirability of Texas vegetables over those grown outside the state as well as to promote the health benefits of eating Texas vegetables for the entire family while at home. Most parents understand that vegetables should be an important part of their child's diet because vegetables are a good source of fiber, vitamins, and minerals. TVA's television and online executions, featured kids and targeted the consumer shopping for groceries – women. The message emphasized the importance of including vegetables in daily meals. The campaign was combined with in-store demonstrations held at various retail outlets in Dallas, Houston, San Antonio and Austin.

The purpose of the *Eating Texas Vegetables at Home Educational Campaign* was to build on current successes with media campaigns, support local produce consumption in restaurants and tout the health benefits of including fresh Texas vegetables as a part of every family's meal. The Texas Vegetable Association partnered with the Texas Department of Agriculture to send the message to consumers:

> 1) Purchase fresh Texas vegetables at your retail grocery store; visit restaurants that purchase/serve local vegetables.
> 2) Tout the health benefits of eating fresh Texas vegetables at home, work, school and restaurants.

In addition to sending the same message to consumers, the overall goal of this promotion is to increase both consumer awareness and sales of Texas vegetables.

The TVA partnered with Southwest Dairy Farmers (SWDF) to promote both Texas vegetables and dairy together through matching funds. By combining budgets and media placements TVA was able to have a greater reach across the state by expanding marketing tactics to include outdoor billboards, point-of-sale collateral (shopping bags) and more to the campaign. The project combined forces to educate consumers about the nutritional value of vegetables and dairy together, encouraging moms to make healthy and delicious recipes pairing vegetables with dairy. The overall goal of this campaign was to increase both consumer awareness and sales of Texas vegetables and dairy. Consumers were encouraged to

visit restaurants that purchase/serve local produce and dairy. TVA utilized funding to buy media in the major markets of Dallas, Houston, San Antonio and Austin.

Project Approach

Project staff worked with an advertising company, Marketing Matters, to develop a creative concept that focused on the strengths of pairing Texas vegetables and dairy. The messaging focused on the different ways to eat vegetables and dairy together and the concept was "Eating your Vegetables in 3-D – Dip, Dunk and Drizzle".

Project staff then worked with SWDF's chef to develop three recipes that would feature each pairing action: dipping, dunking and drizzling. The slogan of the campaign was: "Vegetables and Dairy, better together." The billboards, television commercials, print ads and online ads featured each action, demonstrating to moms that Texas vegetables not only taste great, but they are healthy, fresh and can be paired with dairy and used in many recipes throughout the year.

The media campaign for TVA and SWDF was implemented in two different flights, spring and fall to feature different vegetables. The "Dip, Dunk and Drizzle" campaign included a mix of television commercials, billboards, print advertising, targeted online ads, point-of-sale and event marketing to reach the four major markets in Texas: Houston, Dallas, San Antonio and Austin. The media campaign included 30 second, 15 second and 10 second commercials.

The target demographic was women (moms), ages 25-54. TV shows such as morning news programs, The Food Network, HGTV, Oprah and Ellen were included in the media buy to specifically target the core demographic of just over 2,500,000 women. The TV schedule was combined with in store consumer demonstrations that were held at various retail outlets in the four markets.

As part of the joint project Southwest Dairy purchased 10 outdoor billboards in five major markets in Texas, including: Houston, Dallas, San Antonio, Austin and El Paso. Billboard flights were 4-weeks and ran concurrently with the TV flights, in spring and fall. For spring and fall the outdoor campaign totaled 31 million impressions, as measured by the Daily Effective Circulation (DEC). .

Banner ads and video pre-rolls of the TV commercial were palced on KVUE.com in Austin and KHOU.com in Houston. KHOU also sent out two e-blasts to opt in consumers within the target demo. The e-blast creative featured tasty recipes using vegetables and dairy as the main ingredients. The online ad creative reflected the same consistent message that was featured in the television commercials and billboards.

Together, with TDA, Marketing Matters created and placed an ad and advertorial in The Packer. TVA's ad and advertorial were included, along with the Texas Watermelon Association's (TWA) ad, in a special section that was dedicated to GO TEXAN and the Texas Department of Agriculture. The advertorial explained the marketing campaign and its positive effect on sales of Texas vegetables. The ads also introduced the partnership of TVA and SWDF.

The objectives were to uniquely align the GO TEXAN brand and the Texas Vegetable Association with a very reputable and tasteful food event featuring the best chefs, restaurants, artists, kid's activities and music in Texas. For the second consecutive year, Marketing Matters worked with a partner NBC television affiliate in Dallas and was able to secure The Texas Vegetable Association as a sponsor of the Taste of Dallas as added value for booking a television schedule on the station. TVA was promoted as a sponsor with booth space at the event, signage at the event, inclusion in shared television promotional announcements and logo and click through on the event's website.

Marketing Matters partnered the TVA/SWDF campaign with the Texas Watermelon Association (TWA) campaign as an overall media buy to further maximize television, online and print media purchases for the associations. The strategic marketing partnership between Southwest Dairy Farmers and the Texas Vegetable Association allowed the two associations to combine marketing dollars to reach greater numbers of consumers while creating a powerful media presence than could be achieved by marketing separately. Marketing the two associations together made more of an impact and the two were able to share the investment and combine resources.

Goals and Outcomes Achieved

The TV, billboards and online promotions combined to result in more than 33 million impressions. TVA expected to see an increase in sales of 200 percent, the results of the combined program resulted in a 45 percent increase in sales for Texas vegetable producers and a 128 percent increase in sales of Texas vegetables for retailers. Even though this is lower than expected, the Texas vegetable industry regards this as a very successful project. It is important to note that even though acreage declined in 2011 the value of Texas vegetables increased by 1 percent.

Beneficiaries

The total value of Texas vegetables in 2011 was $290,532,000, up 1 percent form 2010. These marketing events benefited more than 400 vegetable producers in Texas. In addition, promotions impacted sales at more than 3,500 retail grocery stores and 150 Texas restaurants.

Lessons Learned

With both state elections and presidential elections taking place, it was difficult and more expensive than anticipated to find the right spots at the right price.

PROJECT 10: ECONOMICAL POST-HARVEST PRACTICES FOR LEAFY GREENS GROWN ON TEXAS SMALL FARMS

Partner Organization: Texas A&M AgriLife Extension
Project Manager: Dr. Jay Neal
Contact Information: 229 C. N. Hilton Hotel & College, S-137, Houston, TX 77204-3028, Tel: 713-743-2652, Email: jneal@central.uh.edu
Type of Report: Final
Date Submitted: March 2013

Project Summary

The focus of the study is on small farms in response to the exemption of small farms that do not earn more than $500,000 in revenue per year by the Food Safety Modernization Act (FSMA) established by the Food and Drug Administration (FDA) which states the following:

"In general, the owner, operator, or agent in charge of a facility shall […] evaluate the hazards that could affect food manufactured, processed, packed, or held by such facility, identify and implement preventive controls to significantly minimize or prevent the occurrence of such hazards and provide assurances that such food is not adulterated, […] monitor the performance of those controls, and maintain records of this monitoring as a matter of routine practice. The average annual monetary value of all food sold by such facility (or the collective average annual monetary value of such food sold by any subsidiary or affiliate […] during such period is less than $500,000, adjusted for inflation, […]shall not be subject to the requirements […] in an applicable calendar year (FDA, 2012)"

Some of the new farmers may be unaware of Good Agricultural Practices (GAPs) that help reduce the risk of foodborne pathogens at multiple steps during processing. Additionally, small farmers may not be equipped with scientifically validated methods to sanitize and dry the produce grown on their farms before selling it to consumers. By relying on little more than anecdotal evidence as to the efficacy of post-harvest techniques, small farmers could be risking contamination. Current recommendations by the FDA for small farmers involve the use of mesh bags to dry washed leafy greens. The instructions direct the farmers to place the washed leafy greens in mesh bags and swing the bag in vigorous circles. In the event that the farmer has a lot of produce to dry, the recommendation is to place the greens in a mesh bag (possibly in batches) and spin in a clean washing machine for 20-30 seconds (Farmers' market newsletter, 2011). This shows an increasing need to equip the farmers with more specific and scientifically validated methods to wash and dry produce in order to make it safe for the consumers. Washing leafy greens in a natural sanitizer solution and drying it appropriately may increase the shelf life and improve the quality of leafy greens and may reduce the risk of foodborne pathogens.

Along with the increase in produce consumption, consumers are increasingly choosing to support local agriculture. The varying definitions of local food make it difficult to identify the size and scope of the sector (Martinez, 2010). To quantify the development of the local foods market, Economic Research Service (ERS) researchers used census of agriculture data and data from the research firm Packaged Facts (Martinez, 2012). The reports stated that

farmers markets and CSA operations grew threefold from 1,755 in 1994 to 6,132 in 2010. In 2005, there were 1,144 CSAs, up from 761 in 2001 and two in 1986. An online registry maintained by Local Harvest indicated that there now are over 2,500 CSAs in the U. S. (Local Harvest, 2012).

As produce consumption has increased, the Centers for Disease Control and Prevention (CDC) reported another significant trend; an increase in foodborne illnesses associated with produce. Foodborne illness outbreaks are of major concern to the public as the symptoms can range from upset stomach to death. It should be noted that not all outbreaks that occur are bacterial; foodborne illness outbreaks can also be caused by viruses, naturally present food toxins and chemicals. In recent years, an increase in gastrointestinal disease outbreaks has been linked to the consumption of fresh fruits and vegetables. Between 2006 and 2012, contaminated fresh produce was linked to more than 46 outbreaks (CDC, 2012). *E. coli* O157:H7 and *Salmonella* are commonly found in a wide variety of raw meats, dairy products, vegetables (including lettuce), and water (Lang et al., 2004). Contamination with *E. coli* O157:H7 and *Salmonella* may occur on farms through the use of contaminated irrigation water and manure (Bopp et al., 2003).

CDC Researchers found that from 1986-1995, U.S. leafy green consumption increased 17 percent from the previous decade, yet the proportion of foodborne illness outbreaks linked to leafy greens rose 60 percent during the same period. And from 1996-2005, leafy green consumption rose 9 percent while foodborne illness outbreaks linked to leafy greens rose 39 percent (CDC, 2007).

There are many ways for produce to be potentially contaminated by pathogens during production, harvest, and handling. One of the causes of contamination of leafy greens with bacteria is through improperly composted manure that is applied to the fields on which leafy greens are grown. Good Agricultural Practices (GAPs) require proper composting before manures can be incorporated, but assurances are needed regarding the quality of the compost (LGMA, 2007).

In light of these facts, it is especially crucial to provide small farmers with effective and scientifically validated methods to reduce the incidence of foodborne illness.

Currently, chlorine is the sanitizing agent most used by the produce industry mainly due to its antimicrobial activity and low cost (Scharff, 2010). However, increasing public health concerns about the possible formation of chlorinated organic compounds, because of their postulated persistence as an environmental toxin (Hobson, 2011), and the emergence of new more tolerant pathogens, have raised doubts in relation to the use of chlorine by the produce industry (Singh et al., 2002). Upon informal interviews at the farmers market, farmers expressed a preference to using many natural sanitizers, and preferred to refrain from using chlorine (Personal Communication with farmers, 2011).

Chlorinated water (50-200 ppm) is widely used to sanitize whole fruits and vegetables as well as fresh-cut produce on a commercial scale, by conventional growers, but to be certified organic by the USDA; chlorine levels of water in contact with organic commodity must not

exceed 4 mg/l (4 ppm). Hence, other sanitizers such as organic acids have been studied for their effectiveness to increase food microbiology safety (Sengun, 2004). Organic acids are weak acids that are generally considered more effective against foodborne pathogens than inorganic acids such as hydrochloric acid (Sengun, 2004). The antimicrobial classes of organic acids are fully protonated species which can diffuse into the bacterial cell and cause cell death (Brul, 1999).

Vinegar (acetic acid) has been extensively studied for its effectiveness in removing pathogens and spoilage microorganisms from fresh fruits and vegetables with log reductions ranging from 2.3 to 3.9 CFU/g. An independent study tested 1 percent AA on *Salmonella*, *E. coli*, and *L. monocytogenes*, and after 24h observed a log reduction of 1.05, 0.81, and 0.19 CFU/g, respectively (Rhee et al., 2003). Another study performed by researchers at the Ege University in Turkey investigated the use of vinegar (3.95 percent AA) as a sanitizing agent on rocket (arugula lettuce) which caused a maximum log reductions of *S. Typhimurium* of 2.13 and 3.12 CFU/g at 15m and 60m, respectively (Sengun, 2004).

Project Approach

Activity 1. Testing for Appropriate Acetic Acid Concentration

Task: White distilled vinegar (Heinz brand 5 percent acidity distilled white vinegar, Pittsburg, PA) was purchased from a local supermarket typical of that found in U.S. markets. Mixed greens were purchased from local supermarkets in Houston, TX. Ten g samples of leafy greens were placed aseptically in a small salad spinner (Sunbeam, 6 ½ in FlowThru Salad Spinner, Boca Raton, Florida) to replicate the effects of the larger scale device, after setting aside one sample as a control. Each sample was rinsed for 1 minute with 250 ml of distilled water, the water was discharged, and then 5 percent, 2.5 percent, and 1.25 percent vinegar solutions were tested. The vinegar was combined with bottled distilled water to total 250 ml of solution for each round. During each round of concentration testing, the salad spinner was agitated for 2 minutes, and the sample was then rinsed again for 1 min with 250 ml of water to simulate the process that would be conducted on farms. The leafy greens were then spun dry for 1 minute and the leafy greens sample was placed in stomacher bags (Stomacher® lab system classic 400 standard bags, Seward, West Sussex, England) with 90 ml of sterile 0.1 percent Bacto™ Peptone water (Becton, Dickinson and Company, Sparks, MD) buffering solution and blended in a Stomacher (AES CHEMUNEX EasyMIX® Blender, Cranbury, NJ).) for 120 seconds. The sample was removed from the stomacher and 1 ml aliquot was pipetted into a test tube containing 9 ml of peptone buffer. Serial dilutions were made and plated onto Potato Dextrose Agar (PDA) (HiMedia Laboratories Pvt. Ltd, India) with Chloramphenicol (Amresco, Solon, Ohio) plates as well as coliforms/*E. coli* and APC PetriFilms® (3M, St. Paul, MN). APC films were incubated for 24h at 37°C, coliform/*E. coli* films were incubated for 24h at 35°, counted for coliforms, then re-incubated for a total of 48h at 35°C. PDA was held at room temperature (approximately 23°C) for 96h and then counted for yeast and mold colonies.

Activity 2. Building the sanitizing station

Using items readily available at local hardware stores, a leafy greens washer was developed to sanitize and dry leafy greens either in the field or in a postharvest building. The structure is made of a PVC pipe frame with a 5 gallon food-grade plastic drum with a rotating handle, and the device is intended to pre-wash, wash, rinse, and dry the leafy greens. More specifically, the prototype is scaled to a manageable proportion for lab testing; farmers will have the option of scaling the size of the machine to suit their needs. The leafy greens-washer was constructed of a square 1" diameter PVC pipe base with an arm that hinges to lower the attached perforated drum into the retrofitted plastic tub, and then swings back again in its holding position for the pre-wash, post-wash and drying stages. In the first stage of the process, the leafy greens were loaded into the drum of the device, which contains a horizontal drinking-water-grade ½" PVC pipe with small (approximately 3 mm) holes which acts as a sprayer, and the leafy greens is sprayed as the operator slowly rotates the drum with the hand crank as a prewash (as seen in Figure 1, Position A), for approximately 1 min, in order to reduce the amount of soil and debris on the vegetable leaves. In the second stage the operator submerged the drum via the pivoting arm, into the vinegar solution, agitated the drum for 2 minutes to complete the wash cycle (as seen in Figure 2, Position B). The operator lifted the drum out of the solution, allowing the liquid inside to drain out, and again turned on the sprayer to rinse the leafy greens, while spinning, for approximately 1 minute. The sprayer was turned off and the operator continued turning the hand crank, to properly dry the greens.

To validate the prototype, two types of tests were conducted to determine log reductions of microorganisms. Firstly, tests using leafy greens inoculated with surrogate strains of *Salmonella* (ATCC 53647), *Escherichia coli* (ATCC 10798), and *Listeria* (ATCC 33090) were performed. Secondly aerobic plate counts (APC), coliforms and yeast and mold counts were collected to determine the microbial quality of the effects of the device on leafy greens. Fresh mixed greens samples were purchased from a local supermarket in Houston, Texas and transported under refrigerated conditions to the Food Microbiology Laboratory at the University of Houston. The mix included, but was not limited to: arugula, frisee, mesclun, radicchio, and oak leaf lettuce. All leafy greens were kept at 2°-5°C between the time of purchase and initiation of experiments and were then used immediately. *Salmonella* (ATCC 53647), *Escherichia coli* (ATCC 10798), and *Listeria inocua* (ATCC 33090) used in this study were obtained from American Type Culture Collection (Manassas, VA) and store at -80°C in glycerol. Each isolate was streaked on BBL™ Brain Heart Infusion (BHI) agar plates (Becton, Dickinson and Company, Sparks, MD) for 24h at 37°C. Each of the strains were then transferred to 5 ml of BBL™ Brain Heart Infusion (BHI) broth (Becton, Dickinson and Company, Sparks, MD) and incubated for 24h at 37°C. From the inoculated broth, 0.4 ml of each strain was pipetted into 40 ml of BHI broth for 24h at 37°C. On the day of experimentation, 40 ml of each inoculated broth was combined and was added to 3880 ml of Bacto™ Peptone water (Becton, Dickinson and Company, Sparks, MD) to form a bacterial cocktail for inoculation of the leafy greens. The bacterial cocktail was inoculated on leafy greens to obtain a final concentration of approximately 10^6 CFU/g leafy greens. The leafy greens were inoculated according to the dip method as prescribed by the National Advisory Committee on Microbiological Criteria for Foods' (NACMCF) Parameters for Determining Inoculated Pack/Challenge Study Protocols (NACMCF, 2010). The leafy greens were placed in a 22 quart sterile stainless steel container with a perforated stainless steel strainer insert,

submerged in the inoculation cocktail for 10 min with slight agitation, moving the strainer basket insert with vertical motions, ensuring that the entirety of the sample was submerged for the duration of the dip time, then drained in the strainer for 15 min, by suspending it out of the inoculum, slightly agitated by gentle tapping to allow liquid to drip off of the sample, and subsequently allowed to air dry on a sanitized surface for another 10 minutes. Before inoculation, as a negative control, a 10g sample of leafy greens was homogenized for 120 sec with 90 ml of peptone, using a Stomacher. Serial dilutions were performed as required. After inoculation, 150 g of leafy greens were placed in the sterilized drum of the device. The first solution to be tested was a 2.5 percent AA concentration, consisting of 1.5 gal (5.7L) of distilled water and 1.5 gal of vinegar (Heinz brand 5 percent acidity distilled white vinegar, Pittsburg, PA). The drum of inoculated leafy greens was submerged into the wash solution and the drum was rotated with the hand crank for 30 s, 2 min, and 5 min respectively. After each prescribed time, 10g samples were removed from the device with a pair of sterile tongs. The samples were placed in stomacher bags and 90 ml of peptone were then added. The bags were stomached for 120 s and 0.5 ml from the stomached liquid were pipetted out and placed in a sterile 15 ml test tube containing 4.5 ml of peptone. The test tube was then vortexed, the pipette discarded and replaced. At this point, 0.5ml of the liquid was pipetted out and placed into a 15ml tube containing 4.5 ml of sterile peptone. The test tube was vortexed and the process repeated three more times, until obtaining 5 tenfold dilutions. The dilutions were then streak-cultured onto Eosin methylene blue (EMB) agar (EMB HiVeg™ Agar, Levine, HiMedia Laboratories Pvt. Ltd. India) to identify *E. coli* and *Salmonella* colonies and PALCAM *Listeria* Agar Base with PALCAM *Listeria* Selective Supplement (EMD Chemicals Inc., Germany) to identify *Listeria* colonies. The plates were incubated for 37° for 48h and then the colonies were counted.

3. Outreach

Based on the results obtained in this study, educational material in the form of information sheets was developed. The info-sheets have specific instructions on what parts are required from hardware stores and step-by-step instructions on how to assemble the device alongside pictures. The investigators were able to reach out to at least 100 farmers market vendors and small farmers to distribute the material. Project staff surveyed the farmers at the market and one of the survey questions was: "What kind of specialty crops do you grow in your farm?". Based on the results obtained it was shown that at least 90% (N= 90 farmers) were specialty crop producers. Hence, there were 90 specialty crop producers who attended the demonstration at TCFMC. In addition, the device was demonstrated at the Annual Texas Certified Farmers Market Corporation (TCFMC) meeting. To request an information sheet please contact the investigators listed in the contact section. Project staff anticipates including the info sheets on the Texas Food Safety and Defense Taskforce website which is currently under construction.

Goals and Outcomes Achieved

1. White vinegar was the most effective natural sanitizing agent against foodborne pathogens *E. coli*, *Listeria, Salmonella,* and spoilage microorganisms.

The target was to obtain at least 3 to 4 log reduction of pathogenic microorganisms on the greens. Various concentrations and contact times of the sanitizing agent were employed.

From the results, 1.6 percent and 2.5 percent acetic acid were most effective at a contact time of 60 seconds for *Salmonella*, *E. coli*, and spoilage microorganisms.

It can be concluded that the application of 1.6 percent and 2.5 percent white vinegar was most effective at reducing Salmonella and *Escherichia coli* on fresh lettuce up to 3 logs. In addition, 1.6 percent vinegar for 60 s was also effective at reducing aerobic bacteria, coliforms, *E. coli*, yeasts and mold significantly. The results obtained from this objective were used to validate the effectiveness of the sanitizing station.

White vinegar was found to be the most effective sanitizing agent against Salmonella and E. coli. Follow up studies were performed to test the efficacy using the sanitizing device. Overall, the goal was to ensure that the antimicrobial agent is natural and readily available for small farmers.

The results obtained from this objective were very favorably since investigators were able to identify a natural and readily available sanitizing agent that worked effectively against pathogenic surrogates and spoilage microorganisms. This would reduce the risk of foodborne illness and improve produce shelf-life.

A recommendation of approximately three parts vinegar and eight parts water can be made based on the results obtained in this study.

2. The novel sanitizing device was built successful using readily available material from hardware stores.
The overall goal was to develop an economical and effective device (less than $500). The device was built within $100 using simple parts from the hardware stores.

Significant Results: The device was built and the efficacy of vinegar solution against bacteria and spoilage microorganisms was tested on leafy greens with good results. Approximately 1.6 percent acetic acid concentration was the most effective against foodborne pathogens and spoilage microorganisms.

3. Effective outreach was carried out by disseminating the information to over a 100 Texas small farmers

The target was to reach out to farmer market managers, vendors and small farmers. This was achieved by visiting markets and the Texas Certified Farmers Marketing Coop annual meeting to ensure that the information was disseminated. As per the proposed study the investigators anticipated reach out to at least 45 farmers. However, staff exceeded this goal by reaching out to more than 100 growers. They will continue their outreach efforts after the funding period ends. They will also follow up with growers to see how the implementation is coming along.

Personnel changes occurred at Texas AgriLife between the time of proposal submission and grant funding. Our collaborator, Dr. Shari Grahmann at Texas AgriLife, left for another opportunity and we were not able to identify other collaborators. Hence, the investigators

partnered with Mr. Patrick Gendron, President of the Texas Certified Farmers Market Corporation (TCFMC). The Annual TCFMC conference is well attended (at least 100 farmers) every February by farmers around Texas. The conference provided a great platform for us to showcase the sanitizing device, distribute the info sheets and have open one on one communication with our target audience—the farmers. Hence, we were able to target at least 90 farmers who grow specialty crops in Texas. The farmers have been extremely receptive to the device and have provided helpful insight and feedback regarding the workings of the device. Follow up was conducted with farmers with favorable results. The farmers showed some concerns regarding the original prototype design and their suggestions and recommendations were noted. Based on this, a modified and better design was created and new info sheets were designed and handed out. Informal verbal follow up will be conducted at the TCFMC in February 2014.

The investigators visited Plant it Forward farms and community gardens that are implementing the use of this device. Surveys were conducted at the TCFMC in Seguin, TX. Farmers are using this technology in and out of the state. In addition, emails have been sent soliciting farmer feedback on the device. For instance, an extension agent from Cornell University built this device last winter and has been using it successfully. In addition, we have received also received a lot of constructive feedback from several farmers.

Examples of the comments and our responses:
Comment 1: "Not seeing how these pieces fit together. Two photos here - showing parts you are using, inside and outside bottom of bucket would be helpful. Not easy to follow steps in the downloaded document. Maybe better if printed out and assembled in hard copy."
Action: Educational material was modified based on the farmer's comments.

Comment 2: "I have a concern as it is extremely labor intensive to give it a triple wash and dry and bag it for market. I am afraid anything that slows us down will cause an issue with the farmers."

Action: For this comment, staff responded saying that washing the lettuce with vinegar may actually improve shelf-life and quality of the greens. This is because our microbiological study results have demonstrated that washing the greens with vinegar reduces the number of spoilage bacteria. Hence, even if it may be time consuming it may be an effective way for farmers to improve lettuce quality.

Consistent with the original proposal, staff continues outreach on this project after the funding period ended. We have recently partnered with several University community gardens and are working with these growers to develop the sanitizing device.

In 2012, NPR interviewed the investigators about this project. In the video interview, the PI and graduate students explained the working of the sanitizing device. Since then, we have received several emails from farmers across the country expressing their interest in the device. We are still receiving these emails! For instance, we received an email in December 2013 by a farmer interested in the device. As a result of this, we have been in contact with

approximately 10 of the small farmers who produce specialty crops that include leafy greens. Some of these farmers are listed as follows:

- Greg Bowman, Goodness Grows;
- Brian Gronski, Groche Organic Farms, LLC;
- Glen Mentgen;
- Justin Bennet, Bennet Farms;
- Teresa and Colleen, Plant it Forward;
- Marsha LaTessa, Good Water Farms;
- Jeff Lewis;
- Linda Marple and Isaac Maxson, Santa Fe Community Farms;
- Amigo Cantisano Heaven and Earth Farm;
- Sally Daiily, North End Farm.

Co-PI Sirsat has presented this research to Texas sanitation officers in May 2013 at the Central Texas Environmental Health Conference in San Marcos, Texas. Following this, she also presented this research to sanitarians from across the United States at the Southwest Regional Retail Food Seminar in September 2013 held in San Antonio, Texas.

In addition, we have been in contact with extension agents and principle investigators in other states such as New York, Pennsylvania, New Mexico and California. In collaboration, we have been reaching out to farmers across the country so that they can implement this technology.

Beneficiaries

The results of this study aims to improve GAPs on small farms and improve the safety of fresh leafy greens in Texas. The outreach and education material developed is specifically for small farmers. The goal is to reduce the incidence of foodborne illness among consumers. The PI's have received multiple requests from farmers across the country following positive PR from the University of Houston media department. In addition, these results have been presented at several regional and national conferences. These conferences include those attended by small farmers, market vendors and academic professionals. These results have reached a minimum of 150 farmers in Texas and across the country. The potential economic impact is challenging to estimate. However, the goal of using this sanitizing devise is to improve food safety and reduce the risk of foodborne pathogen disease in humans. The public health and economic impact can directly or indirectly affect work productivity (not missing work due to illness) and improvement of farmer business.

Lessons Learned

The investigators were able to interact with the farmers before and during the outreach component of this project. In this process, the farmers had several ideas and suggestions to improve the device and questions about other natural sanitizing produces (e.g. hydrogen peroxide). Based on this feedback, the investigators will continue to improve the device after the funding period ends and provide outreach to farmers.

Additional Information

The results of this study were presented at the International Association of Food Protection (IAFP) and American Society of Microbiology (ASM) conference in 2012 by the students working on this project and the PIs. Investigators Sirsat and Neal are currently working on a manuscript to document the results of this study. The manuscript will be submitted for publication in a peer-reviewed scientific journal.

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LEAFY GREENS-WASHER PROTOTYPE

PROJECT 11: DEVELOPMENT OF THE TEXAS SENSITIVE CROPS WEBSITE

Partner Organization: Texas A&M AgriLife Extension Service
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Type of Report: Final
Date Submitted: January 2013

Project Summary

Many specialty crops are sensitive to off-target drift from commonly used pesticides, especially herbicides, applied in other cropping systems or non-crop situations. Damage and economic loss has occurred to grapevines exposed to spray drift of phenoxy-type herbicides such as 2,4-D. Specialty crops grown in Texas that are known to have sensitivity to pesticide drift include, but are not limited to: grapes, pecans, nursery crops and watermelons. Organically grown crops can be contaminated by pesticide spray drift from distant applications, disqualifying the contaminated crop for organic certification.

Texas cultivates nearly 440,000 acres of specialty crops on 13,400 farms (USDA 2007) and continued expansion is important to the Texas economy. The Texas wine industry has an annual economic impact on the state of Texas of $1.7 billion (MFK Research 2009). Off-target drift of pesticides is a serious recurring problem that causes significant damage to Texas specialty crops, many of which are perennial plants. Accurate assessments of economic losses are unavailable, primarily because of producer reluctance to report damage.

Damage to specialty crops from spray drift was investigated in 2010 by the Texas Senate Committee on Agriculture and Rural Affairs, which was given the following charge by the Lieutenant Governor: "Study the impact of windblown herbicides on grape growing and other agricultural production. Make recommendations for improving the safety and quality of Texas agricultural products." The committee's interim report to the 82nd Legislature recommended that the Texas Department of Agriculture follow the example of other states and establish and maintain a database providing the location of every commercial vineyard in Texas (Senate Committee on Agriculture and Rural Affairs 2010).

The purpose of this project was to develop a spatially explicit website which producers of all pesticide-sensitive specialty crops can use to mark the locations and activities of their operation in Texas. The goal was to have this real-time information available to pesticide applicators so they could modify treatments in order to minimize damage to nearby specialty crops and reduce economic loss due to off-target drift. The objectives of the project were:

1. Develop a *Texas Sensitive Crops Website* to enable Texas producers of specialty crops to map their farm locations and post relevant information regarding their pesticide-sensitive crops.
2. Inform producers of specialty crops and other sensitive crops about the *Texas Sensitive Crops Website* and encourage all producers to input their information.

3. Inform pesticide applicators about the *Texas Sensitive Crops Website* and encourage its use to avoid unintended pesticide drift to sensitive crops.

Project Approach

During the first months of the project, an intensive review of sensitive crop websites developed for other states was completed. This review served as a starting point for the development of the *Texas Sensitive Crops Website* (*TSCW*).

After the critical review of sensitive crops websites for other states, a working prototype of the *Texas Specialty Crops Website* was developed. The design of the *TSCW* consists of three main components or interfaces: one for crop producers, one for pesticide applicators, and one for the general public. The producers interface allows the crop producers to register and map their production location and enter specific information related to their site into the website.

The applicators interface allows the pesticide applicators to register and enter their preferences for notifications of sensitive crops based on location at three different levels: statewide, countywide, and specific locations of interest to the applicator. The public interface displays information and location of sensitive crops within Texas (see Additional Information section of this report).

A demo of the website (http://queen.tamu.edu/tsc_dev/) was presented to the Texas Department of Agriculture in May of 2012. As a result of the meeting, a list of discussion points was created. The issues that needed to be addressed were related to the implementation and use of the website by the stakeholders.

During a meeting at TDA in September 2012, a demo of the working prototype solution was introduced to stakeholders: specialty crops producers and pesticide applicators. Information discussed, included the following: (1) functionality and content of the website; (2) a plan for care/maintenance/update of the system; and (3) an implementation plan for the system. The potential benefit to specialty crops producers was evident; however there were some concerns on the pesticide applicators side about privacy, potential legal problems, as well as other uses that the website could address. The implementation and testing of the *TSCW* was still one of the main issues.

In November 2012, the *TSCW* was presented to the Board of Directors of the Texas Wine and Grape Growers Association (TWGGA). Discussion was held with regard to the implementation and testing of the system, as well as continued funding. TWGGA is committed to help guide the further development of the TSCW by evaluating working versions of the website and making recommendations for improvements and modifications.

Goals and Outcomes Achieved

It was estimated that by the conclusion of this grant 500 specialty crop producer locations would be mapped and 100 pesticide applicators would be using this resource to avoid damage to non-target crops by inadvertent pesticide drift from target crop applications; however, the project has not reached implementation but instead is still in the testing phase.

Project staff believes this to still be a realistic long term goal but additional time and effort to publicize the website are needed.

Beneficiaries

Since the *Texas Sensitive Crops Website* has not been fully implemented, project staff does not have a quantitative measure of success/use by the beneficiaries. However, the *TSCW* has a large potential to benefit three groups of stakeholders:

1) Producers of crops that are sensitive to pesticide spray drift, including, but not limited to, many specialty crops such as grapes, pecans, nursery crops, and watermelons. Note that, given the protection offered by the website, beneficiaries may also include *prospective* producers of specialty crops. The website will also benefit approximately 300 organic (or transitioning) producers, and bee keepers.
2) Pesticide applicators required to avoid drift as specified on the pesticide label.
3) Texas Department of Agriculture for monitoring the issue of off-target drift damage to specialty crops.

Specialty crop producers potentially impacted by the *Texas Sensitive Crops Website* number in the tens of thousands, representing thousands of crop acres in Texas. Additionally, other pesticide-sensitive crops that are not specialty crops, such as cotton, could benefit from participation in this website.

Producers of specialty crops and other pesticide-sensitive crops will benefit from the *Texas Sensitive Crops Website* through reductions in plant and/or crop damage and yield loss. Economic competitiveness of specialty crops and other pesticide-sensitive crops will be enhanced.

Lessons Learned

Successful implementation of the *Texas Specialty Crops Website* will depend on the involvement of interested stakeholder groups. The development and design phase of the project was accomplished in a timely manner and the system is ready to be deployed to the users. However, additional information is still being gathered to further the development of this site for Texas grape growers.

The work plan did not take into account the necessary data requirements that fit the needs of all applicable users. There will always be ongoing costs associated with the development and maintenance of this site and it has taken more time than anticipated to find a sponsor organization willing to further the design and implementation.

A greater visibility (advertisement) of the existence of this system will have an impact to attract potential users (specialty crops producers, pesticide applicators, policy managers and makers, general public, etc.).

PROJECT 12: PRODUCTION AND MARKETING STRATEGIES FOR SPECIALTY MELONS AND ARTICHOKES

Partner Organization: Texas A&M AgriLife Research at Uvalde
Project Manager: Daniel I. Leskovar
Contact Information: Daniel I. Leskovar
Type of Report: Final
Date Submitted: March 2013

Project Summary

The main goal of this project is to expand the commercial production of specialty melons and artichokes in Texas. Traditionally, cantaloupe and specialty melons like Tuscan type and honeydew are considered a spring-summer crop while globe artichoke is typically a fall-winter crop. This project started in fall 2011 (artichoke) and spring 2012 (melons) with an initial target duration of three years. During the first year, staff evaluated planting and crop management systems (irrigation, mulching, planting configuration and cultivars) for artichokes and different melon gentoypes and commercial cultivars in growers' fields and research fields. In addition, a consumer preference study was conducted for melons. Producing fresh, locally grown, and high quality specialty melons and artichoke is expected to have economic benefits to producers and nutritional benefits to consumers.

Project Approach

1. Evaluation of artichoke and melon production performance

Three sites were established for artichoke field evaluations. The first two commercial sites were conducted at M. Ortiz farm in Brownsville (Lower Rio Grande Valley, LRGV) and at R. Becker's farm in Stonewall (Hill Country). Mike Ortiz grew 30 acres of artichoke, which was considered the largest production area known for this crop in Texas. Staff evaluated four cultivars, Emerald and Imperial Star (green types), and hybrid cvs. Madrigal (green) and Concerto (red).

At the Stonewall location, the main two cultivars were Imperial Star and Green Globe. In addition, a small plot was planted with Madrigal, Emerald, Purple Romagnia, Experimental Red, Concerto and Opal. At the Texas A&M (TAMU) AgriLife Center artichoke cvs. Green Globe and Imperial Star were planted to screen for improved traits such as earliness, vigor, head shape, head size and color. These plants were left for a ratoon crop in 2012 and are now currently in the vegetative stage. In addition single plant selections were made and off-shoots were potted to grow in the greenhouse for seed production.

For melons, new, elite F1 hybrid honeydew, cantaloupe and Tuscan types from the TAMU breeding program, as well as commercial ones were planted in Uvalde, College Station, and two locations in the Lower Rio Grande Valley. The multi-location trials were evaluated in terms of growth, yield and quality. Yield and resistance to powdery and downy mildews were assessed for 45 experimental hybrids and 205 breeding lines at Weslaco and 48 elite experimental hybrids and breeding lines at Uvalde. Fruit samples were collected from each

line and the following data were recorded: yield, size, shape, rind appearance, total soluble solids, flesh color, flesh firmness, seed cavity size, abscission scar size, and flavor. An additional trial evaluated root growth patterns, plant physiological responses, fruit quality and yield of three specialty melons (cvs. Mission, Da Vinci and Super Nectar) in Uvalde and Weslaco fields.

In artichoke trials, plant survival was over 90 percent under plasticulture system in Stonewall and Uvalde and 85 percent under bare soil in Brownsville (LRGV). The lower plant survival under bare soil was related to the stronger negative effect of drought and high temperatures during transplanting, whereas plastic mulch was able to mitigate these stresses. During the early vegetative phase plants were treated with gibberellic acid to induce bolting in Brownsville and Uvalde tests. The response to this treatment was evident for the early varieties Emerald and Imperial Star, which produced commercial marketable heads, but this treatment was not successful in inducing bolting and head formation for the late varieties Madrigal and Concerto in Brownsville. All artichoke heads harvested from the early varieties were sorted (by size), packaged, transported and marketed successfully in the Austin markets, including farmers markets. In Stonewall, most varieties produced heads without the application of gibberellic acid. Best performers were Green Globe Improved, Imperial Star and Madrigal. This grower extended the growing period past head formation, to full flowering, and successfully marketed dried flowers to tourists in the Hill Country area. For melons at Weslaco, 6 cantaloupe and 2 honeydew hybrids were identified with attributes superior to the commercial check hybrids. Also, 168 breeding lines were selected with desirable fruit quality or disease resistance traits. At Uvalde, 5 cantaloupe, one canary and one honeydew were identified with superior fruit quality and vine vigor compared to the commercial checks. At College Station, nine new experimental hybrids of both muskmelon and Tuscan types were created by controlled pollinations in a greenhouse. These include parents resistant to multiple vine decline fungal pathogens.

Replicated field trials of 25 new experimental melon hybrids to assess commercial value were evaluated at Weslaco and Uvalde. Plants were rated for powdery mildew and maturity, while fruit size, sugars and firmness were recorded. The best 14 entries were also sent to a food safety lab in Arizona to sample for human pathogenic bacteria such as Listeria and Salmonella. Six of the hybrids, including 4 cantaloupes, one honeydew and one green-flesh muskmelon were selected as candidates for expanded commercial trials. These all exhibited good mildew resistance and yield, as well as good flavor and texture. Additionally, the orange-fleshed casaba was released as an o.p. cultivar 'Pacal' for specialty melon growers.

2. Planting systems for artichokes

At Uvalde Center project staff established a planting configuration experiment under subsurface drip irrigation. Treatments include two cultivars (Green Globe and Imperial Star), two culture systems (plastic mulch and bare-soil), and two planting systems (single and double lines). Transplants were established in the field at 6.6 feet between rows and 3 feet between plants (single line) or 13.2 feet between rows and 3 feet between plants (double line), keeping the same plant population. In both cultivars, black plastic mulch enhanced plant growth and increased yield earliness. The combination of single line with plastic mulch enhanced leaf number and plant width. Chlorophyll index was not affected by either planting

configuration or plastic mulch. Comparing cultivars, Green Globe Improved had similar growth components but lower marketable yield than Imperial Star. These results indicate that black plastic mulch is recommended to enhance plant growth and increase yield earliness and water savings (more than 20 percent) as compared to the baresoil system.

3. Marketing of specialty melons

A major goal for the marketing section was to assess consumer preferences for these specialty products. An experimental auction mechanism was developed in conjunction with other consumer information to analyze important product attributes for consumers and willingness to pay for specialty melons. The experimental auction for testing specialty melons was conducted using some traditional varieties as benchmark. In addition there was a taste panel of consumers (n=83) providing rates from 0 (worst) to 10 (best) for six different characteristics of the melons. Across all product attributes, the Tuscan melon received the highest ratings. Tuscan's color (8.5/10) appeared to be the highest valued attribute, followed by its freshness and overall appearance (8.0/10), taste (7.7/10), sweetness (7.6/10), and smell (7.1/10). Cantaloupe was the melon that received the second highest ratings in terms of color, smell, freshness and overall appearance. These two melons had overall higher rankings than Galia, Canary and Honeydew type melons. In terms of consumer willingness to pay (WTP), on average, consumers from all sessions (n=172) were willing to pay a price premium for a food safety certification label issued by either the government or the industry compared to non-certified melons (i.e. the baseline bids). The WTP results depended on whether fruits were tasted or not. For example, after tasting fruits, consumers WTP increased only for Tuscan melons. Project staff continue to analyze the WTP data from the experimental auction procedure. A new consumer preference study was conducted in April 2013, to elicit preferences and willingness to pay for several artichoke products, including fresh and readily available processed products. Results have been included in the additional information section.

Goals and Outcomes Achieved

In conjunction with team members (Crosby and Palma) and participating growers staff have completed the activities related to the following objectives:

1. Establish artichoke and specialty melon production sites with producers and TAMU Centers (cultivar trials, open pollinated and hybrid genotype selections);
2. Select planting systems and season extension techniques (drip irrigation, plasticulture, planting configurations), and
3. Marketing (consumer preferences and surveys for melons).

The data obtained from the first year (short-term), will assist (long-term) in the application and validation of best production strategies and treatments in growers' fields (Objectives 1 and 2). Similarly, results and experiences shared with the growers will be used in educational activities related to production and marketing in order to demonstrate BMP from seed to harvest. Similarly, data obtained will be used to create future business plans, and cost and pricing strategies. Before the project started there was very limited production of artichoke (less than 10 acres). Artichoke heads produced from the 30 acre plot produced at the farm owned by M. Ortiz in Brownsville were successfully sold in different direct channels such as farmers markets as well as retailers such as 'Whole Foods' in Austin. Similarly artichoke

heads and dry flowers produced from the trials at Stonewall were sold to visitors directly at the farm. Here, the farmer also provided educational programs on the use of this commodity as a food product. More than 30 people participated in this program.

In melons, 5 grower trials were conducted of the new experimental hybrids in three regions of Texas. Staff evaluated and selected more than 200 advanced breeding lines of specialty melons with high sugars, mildew and vine decline resistance and large fruit size. In the process, researchers have developed both inbred lines and hybrids with larger fruit (size 9), better firmness and higher brix (12-14 percent). Staff produced seed of both o.p. and hybrid melons for grower trials and collaborated with two seed companies to assess the commercial potential of several cantaloupe and green fleshed melon hybrids. Enterprise budget templates have been developed to use as reference. Data is being obtained from growers to compile cost of production under several production scenarios. Willingness to pay models developed for melons will be used to estimate price premiums for the selected specialty melons.

The major growers, Mike Ortiz and M. Jedd have created a company (MO) that grows, promotes, markets and disseminates the benefit of high quality, fresh and locally produced globe artichoke for Texas markets. This is done through the 'Go Texan' identity. In addition they have partnered with Texas AgriLife Communication Department and Texas A&M AgriLife Uvalde in the development and release of a promotional video depicting artichoke production, quality and marketing in Texas and for Texans.

Surveys were conducted for consumer preferences and products for both melons and artichoke products. Since the numbers of initial growers were very limited, project staff does not have a baseline in terms of growing knowledge. This project has been funded through the 2012 and 2013 Specialty Crop Block Grant and we hope at the end of the project to develop such a survey for participating and potential interested growers.

Beneficiaries

Conventional and organic growers have expressed interested in diversifying production with specialty crops, including melons (cantaloupes, canary and Tuscan types) and artichokes (green globe and red). Currently 7 to 8 growers are benefiting from the project. The consumer preference studies gave supporting evidence for these products (e.g. Tuscan melons and large green/red fresh artichoke heads), since the provide a premium price, thus may offer additional income to their production. Increasing consumption in the Texas markets will have a direct implication in enhancing the economic impact of these commodities and due to their healthy attributes, contribute to enhance consumer's diet and nutrition.

A specific group of emphasis is growers targeting direct marketing and small and medium size farmers looking for specialty crops in order to increase profits. Consumers also benefit from the availability of a supply of fresh, safe and healthy products. Field tours to interested growers were conducted at the Uvalde Center. In addition, results and lessons learned from this research were presented to several growers in the LRGV, Wintergarden and Hill Country area, including growers' organizations such as Texas Organic Farmers and Gardeners Association (TOFGA) and community-based organizations in San Antonio and Uvalde.

Two large conventional melon producers, one in Edinburg and another in Carrizo Springs expressed interest in continued collaboration to develop sweeter melons for south Texas production. These growers produce the majority of the 1,500 acres of cantaloupes in the region for the early summer period. Flavor and yield are the top priorities addressed in the trials during the life of this project. The availability of seed for new cultivars is also an issue which was addressed directly through controlled hybridization to produce trial seed and reaching out to seed companies to arrange for commercial production. Staff produced 30 lbs of o.p. seed of the 'Pacal' casaba melon in isolation plots so that growers would have sufficient supply to expand trial plantings. This includes two organic producers, one near Austin and one in Pleasanton.

Texas consumers purchase around 165 million pounds of cantaloupe and around 9 million pounds of artichokes annually (based on national consumption averages). In 2012 Texas growers harvested 2,300 acres of cantaloupe (30 million pounds) with a farmgate value of $10 million. (Texas Ag Statistics)

Lessons Learned

One lesson learned is that seed production may be the biggest impediment to delivering new melon cultivars adapted top Texas production environments. Commercial seed companies have largely lost interest in Texas as a market for melon seed, making production of a new hybrid more difficult. An unexpected outcome is that melon production declined dramatically in Texas over the past three years as a result of numerous economic factors. Locating growers interested in producing specialty melons was more difficult than anticipated.

With artichokes, the expansion of marketing and promotion activities to enhance consumer demand and thus production area is needed. The highest demand for artichoke products comes from consumers in large cities and upscale restaurants, thus local farmers' markets are ideal marketing channels. Other direct marketing outlets include retailers such as Whole Foods and HEB and community supported agriculture (CSA). In terms of seeds, there is limited availability of commercially adapted cultivars to drought and semi-arid conditions, especially since not prior efforts have been made in selecting and developing artichoke cultivars for Texas. Staff is screening individual plant selections from Imperial Star and Green Globe cultivars that have shown better adaptation to southwest conditions and expect to have new seeds available for testing in 2013/2014 season.

Additional Information

Tasting Results

Consumers (n=196) rated from 1 (Extremely Dislike) to 9 (Extremely Like) six different attributes of the artichokes. The average ratings for all participants for all attributes are shown in Table 1. Across most of the product attributes, the canned, large, and purple artichoke received the highest ratings. It received the highest ratings for appearance (6.6/9), color (6.6/9), smell (5.6/9), taste (6.2/9), and overall acceptance (6.3/9). However, the two fresh varieties developed by Texas A&M received the highest ratings in terms of freshness. Among the fresh varieties, the large, green artichoke received the highest ratings for all the attributes. The two fresh, purple varieties received the lowest ratings across all attributes,

except for freshness. Regardless of size and color, a comparison of canned artichokes with those presented in glass containers revealed that the canned artichokes received equal or higher ratings in terms of appearance, color, smell, and freshness.

Table 1. Tasting average ratings.

Artichokes	Appearance	Color	Smell	Taste	Freshness	Overall Acceptance
Fresh, Large, Green *	4.7	4.9	5.3	5.8	6.4	5.8
Can, Large, Purple	6.6	6.6	5.6	6.2	5.8	6.3
Glass, Large, Purple	5.2	5.2	5.2	5.6	5.1	5.5
Can, Small, Green	6.4	6.4	5.5	5.8	5.9	5.8
Glass, Small, Green	5.5	5.4	5.5	6.0	5.5	5.9
Fresh, Small, Purple *	4.5	4.7	5.2	5.1	6.2	5.3
Fresh, Large, Purple	4.5	4.4	5.1	5.1	6.0	5.2

*These varieties were developed by the Horticultural Department at Texas A&M University.

Willingness-to-pay (WTP)

On average, consumers from all sessions were willing to pay a higher amount for fresh and large artichokes (Table 2). On the other hand, a lower average WTP was reported for the fresh, small, and purple artichokes. After information about the health benefits of consuming artichoke was provided to consumers, their WTP increased for all products, except for large and purple artichokes packaged in glass container. At the same time, posterior to the tasting treatment, participants' WTP for all products decreased.

After consumers received information about the health benefits of consuming artichokes, they were willing to pay price premiums in the range of $0.05 (Glass, small, green artichoke) to $0.15 (Fresh, small, purple artichoke). Afterwards tasting the vegetables, consumers were not willing to pay any price premium for the artichokes.

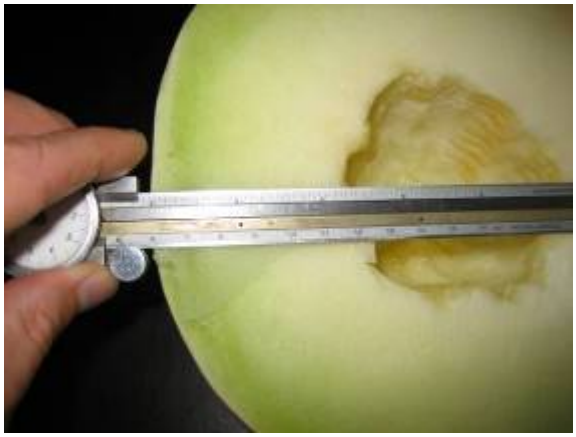
Table 2. Average willingness-to-pay per treatment in US dollars and cents.

	Fresh, Large, Green	Can, Large, Purple	Glass, Large, Purple	Can, Small, Green	Glass, Small, Green	Fresh, Small, Purple	Fresh, Large, Purple
Baseline	**2.00**	**1.76**	**1.95**	**1.77**	**1.77**	**1.57**	**2.38**
Health	**2.10**	**1.84**	**1.87**	**1.84**	**1.82**	**1.72**	**2.32**
Tasting	**1.80**	**1.73**	**1.72**	**1.67**	**1.73**	**1.42**	**1.76**

Melon and Artichoke Illustrations

Uzbekistan melon

Pacal – orange casaba



Uvalde 30 line – honeydew

Green Globe artichoke

Dense planting system with mulch

Packed artichokes in 18-count boxes

Packing at Mike Ortiz Farm in Rancho Viejo (Lower Rio Grande Valley)

Cantaloupe Mission

Tuscan type Melon

Honewdew Super Nectar

PROJECT 13: TRUFFLE PRODUCTION IN TEXAS: ADDING VALUE TO THE PECAN INDUSTRY

Partner Organization: Texas Tech University, Texas Pecan Growers Association (TPGA) and Texas Pecan Board (TPB)
Project Manager: Dr. Jyotsna Sharma
Contact Information: 806.742.2637; Jyotsna.sharma@ttu.edu
Type of Report: Final
Date Submitted: March 2013

Project Summary

Truffles are not commercially produced and marketed in Texas even though the native pecan truffles are known to grow around pecan trees and that Texas is the country's second-largest producer of orchard-grown pecans. While states in the northwestern U.S. are capitalizing on their native truffle species, production methods for growing truffles, including the pecan truffle, are not available to growers in Texas. Because of their specific climatic and edaphic conditions, methods of truffle production developed in other regions of the country or the world are of very limited use for Texas growers. Production methods specific for growing conditions in Texas and knowledge of optimal ripeness for harvesting truffles are needed. Economic analyses of growing truffles as crops also are equally important to enable growers to make informed decisions. This project initiated the development of production methods for pecan truffles in Texas.

Project Approach

With close collaboration from Texas pecan growers, USDA pecan breeders, Oregon truffle and truffle dog specialists, and several educators and academics across the southeastern U.S., project staff accomplished the objectives proposed.

1. **Assess pecan orchards in Texas for presence and yield of the Texas native pecan truffle (*Tuber lyonii*, also known as *Tuber texense*).**

Pecan truffle surveys were conducted throughout the state of Texas in October/November 2011, June/July 2012, and in October/November 2012.

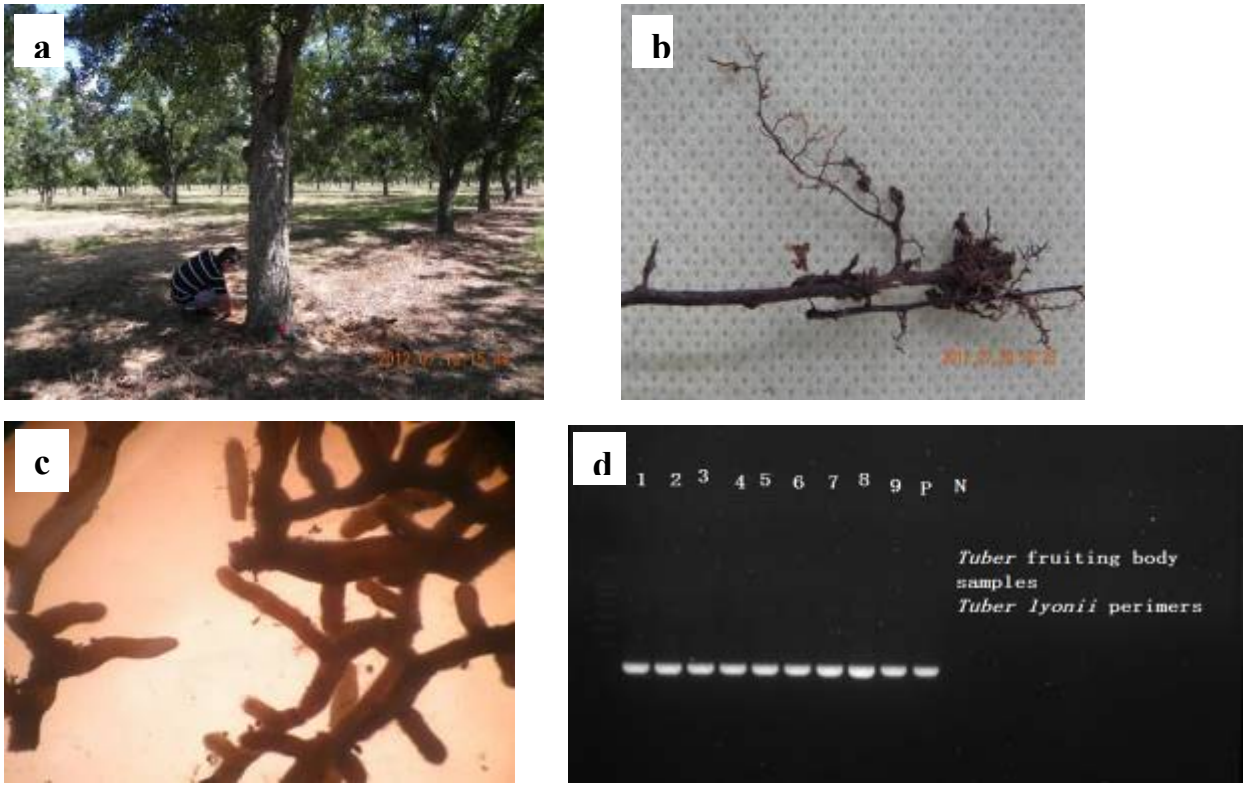
With the assistance of growers throughout Texas, staff conducted searches for the pecan truffle in pecan orchards. The severe drought in Texas in 2011 and the late time of season (truffles fruit from April to October mostly) were likely responsible for the apparent lack of abundant truffle fruiting. Staff chose not to collect roots for molecular analyses in late fall of 2011. Several orchard owners have informed us that they have observed pecan truffles at their farms in previous years, however, due to the drought some of them chose not to irrigate the orchards in 2011 and staff did not see the truffles fruiting.

In the summer of 2012, many orchards were surveyed to collect roots from pecan trees to determine the presence of pecan truffle fungi in the roots of the trees. The effects of drought were still evident and fruiting bodies were not located. However, in the root samples, project staff has identified *Tuber* species. It is possible that the *T. lyonii* fungus may not be present

because there are other *Tuber* species that occur naturally, but it is also possible that Texas has a variant of *T. lyonii* and that it is different from *T. lyonii* found in other parts of the Southeast. This could be a significant find for Texas pecan growers as it would give truffles a marketing advantage if the differences also translate into aromatic differences.

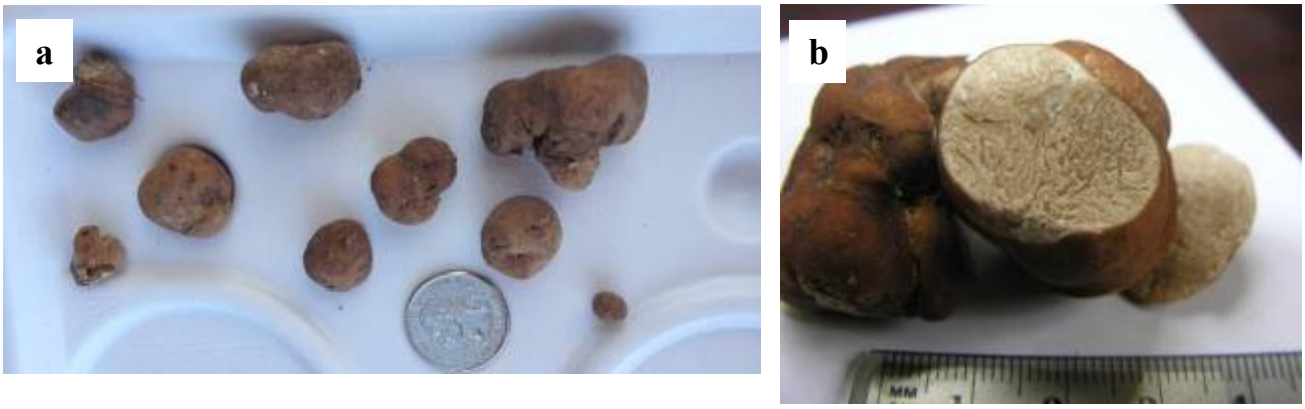
Project staff continually circulated information on pecan truffles to pecan growers in Texas via a presentation at Texas Pecan Growers Association (TPGA) conference, e-mails and informational flyers to help them identify pecan truffles (Fig. 1). Many growers contacted project staff to ask if the fruiting bodies they had found were truffles or something else. In short, the interest in pecan truffle has grown since this project began and in this short time, growers have become increasingly interested and aware of this valuable specialty crop that could have great economic potential. Dr. Jysonta Sharma and Mr. Shi Wang, graduate student presented an informative talk at TPGA annual conference in San Marcos, Texas in July 2012 to an audience of approximately 250 pecan growers, researchers, and members of public from across the state. This presentation created interest in growers for locating truffles at their orchards. At this conference, a survey was conducted to assess the interest of pecan growers and managers in collaboration. More than 25 percent of the respondents were interested in having project staff visit their orchards to locate truffles. Those that expressed this interest also voiced support for using inoculated trees for plantings in the future.

Figure 1. Pecan orchards across Texas have been surveyed for fruiting bodies and for mycorrhizal fungi in the roots of pecan trees (a). Roots were extracted carefully (b), examined to locate ectomycorrhizal tips (c), and DNA analyses (d) were conducted to determine the presence of truffle fungi. *Tuber* fungi were detected in several samples and some matched *Tuber lyonii*. This is a great tool for determining the presence of the fungus in the absence of fruiting bodies.



In October 2012, researchers located fruiting bodies of pecan truffle in Texas pecan orchards (Fig 2). This is a very significant find, considering that in Texas, *T. lyonii* had not been vouchered by anyone since 1997. Researchers extracted the DNA from these fruiting bodies to determine their taxonomic identity more fully, all DNA samples from Texas match *Tuber lyonii*. It is evident that improved precipitation during 2012 also helped. Additionally, the use of a trained truffle dog seems to be very important in conducting efficient truffle searches. The difference in the quantity of truffles found with the help of a dog can be 5 times or more than the quantity found by humans alone (Smith et al. 2012).

Figure 2. As a direct result of this project, pecan truffles have now been recorded in pecan orchards in Texas for the first time. Whole truffles are shown immediately after collection **(a)**, and a sliced truffle shows the typical marbling **(b)** of a culinary truffle. Pecan truffles appear to have a fairly long shelf life. So far, project staff has been able to store them 'fresh' for up to 3 to 4 weeks after harvesting without noticeable degradation. This characteristic is remarkable given their high economic value and the perishability of other truffles.



2. Evaluate growth and yield of truffles by inoculating pecan seedlings with truffle species.

To evaluate the growth of pecan seedlings upon inoculation with truffle fungus, staff conducted controlled environment experiments because field experiments were not feasible in light of the severe drought experienced in Texas. It would have been unwise use of resources to conduct field research alone.

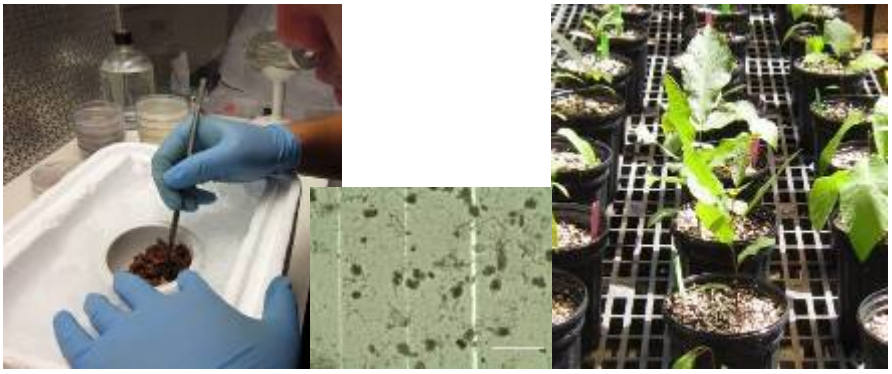
First, amendments required to raise the pH of the growing substrate for optimizing truffle growth in mycorrhizal association with pecan seedlings were tested. Several concentrations of $CaCO_3$ were tested to determine the precise amounts required to raise the substrate pH to the desired levels. These tests also determined the time period for which the desired pH remains stable.

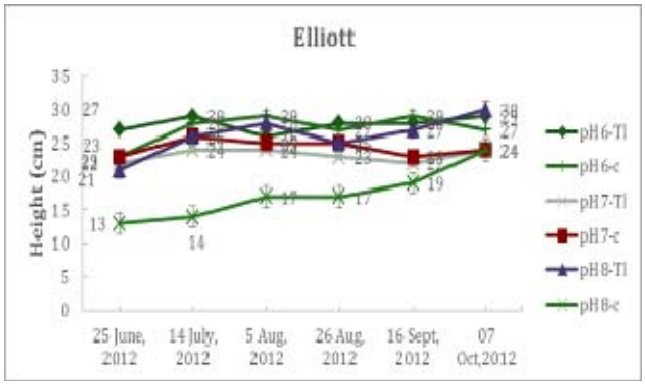
Pecan seeds of the cultivar 'Elliott' and a natural variety were acquired from Gary Lehman (a Texas pecan producer) and from USDA ARS Pecan Breeding Station, respectively. Hal Berdoll, Texas pecan nursery grower also assisted with growing information. Staff stratified

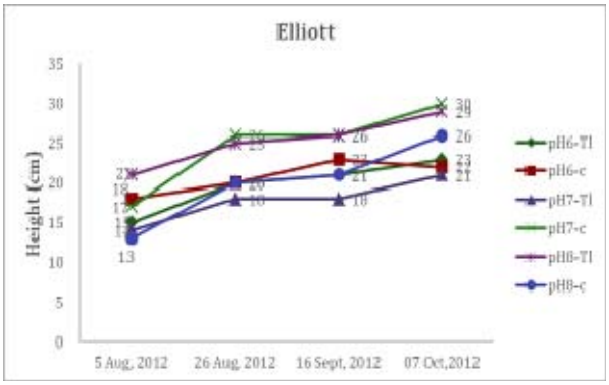
the seeds for 1.5 months after which they were sown in sterile medium. Inoculum of *Tuber lyonii*, which was acquired through research colleagues in other states, was quantified for spore concentration. *Tuber lyonii* inoculum concentration (number of spores per gram of ascocarp) was measured and determined to be approximately 3.7 x 10^6 / g. The suspension was maintained at 4C until utilized.

Seedlings were inoculated by supplying 1g of inoculum to each seedling at the time of transplanting into greenhouse containers. Inoculated plants were grown under greenhouse conditions with a 16:8 photoperiod. Researchers tested three pH treatments (6, 7, and 8) to assess the growth of the inoculated plants, especially at higher pH. *Tuber* species tend to prefer higher pH and the results show that the Mexican variety appears to tolerate higher pH better (data not shown). However, inoculated plants grew better, or as well as, than those without inoculation (Fig. 3). Results indicate that pecan growth may not be compromised by truffle inoculation at higher pH.

Figure 3. Seedlings of pecan were inoculated with spores of *Tuber lyonii* at the time when they were transplanted into greenhouse containers. Both experiments show (see graphs) that growth of pecan seedlings is higher than, or equal to, growth without inoculation, even under the higher pH treatments which are more conducive for truffle fungi.







3. Conduct aromatic chemical and sensory analyses of culinary truffle species/products

Flavor extraction

French black Périgord truffle (*Tuber melanosporum*) harvested in winter 2012, Italian black truffle oil, and *Tuber lyonii* from Florida harvested in October 2012 were used as the substrates. The Stir Bar Sorptive Extraction (SBSE) technique is based on the use of polydimethylsiloxane (PDMS), an apolar sorbent polymer, as the medium of extraction of analytes in aquatic and gaseous samples. Sample extraction is performed by placing flaked truffle sample or aquatic truffle oil in a 20 ml amber vial, spiking internal standard (EEP, 2-ethoxy-3-ethyl pyrazine). The stir bar was attached inside a metal cap. The vial is sealed with the cap to avoid evaporation or loss of volatiles into the air and stirring for 60 minutes under 50°C. After extraction the stir bar is removed and placed in a glass liner fit for GC inlet.

Table 1. Gas Chromatograph instrumentation.

GC column:	Agilent HP 5, 30 m×0.25 mm×0.25 mm
GC system:	Agilent 6890
Inlet:	Splitless 200°C
Helium flow:	1.2 ml/min (constant flow)
Oven:	Initial 40°C for 5 min, 4°C /min until 200°C, 20°C /min until 250°C
Aux heater:	280°C
MSD:	Agilent 5973, full scan EI mode, Voltage=1329V

Results and discussion

Qualitative volatile GC-MS profiles were determined among the three samples. Bis(methylthio)methane (2,4-dithiapentane), a known truffle oil flavor additive, was not detected in the French truffle and the pecan truffle, but a high amount was determined in truffle oil (retention time 9.289min). Bis(methylthio)methane is described as smelling like cheese, horseradish, earth, onion, garlic and spice.

Preliminary non standardized, non-randomized aroma sensory comparisons of three different truffle samples are as follows:

1. French black Périgord truffle - intense complex aromas of dried plantain/banana, quince jam, onion, blueberry, and earth.
2. Italian black truffle oil - intense aromas of onion, garlic, cheese, without fruity aromas.
3. Pecan truffle - aromas of mushroom and earth.

Figure 4. Gas chromatograph for frozen French black truffle.

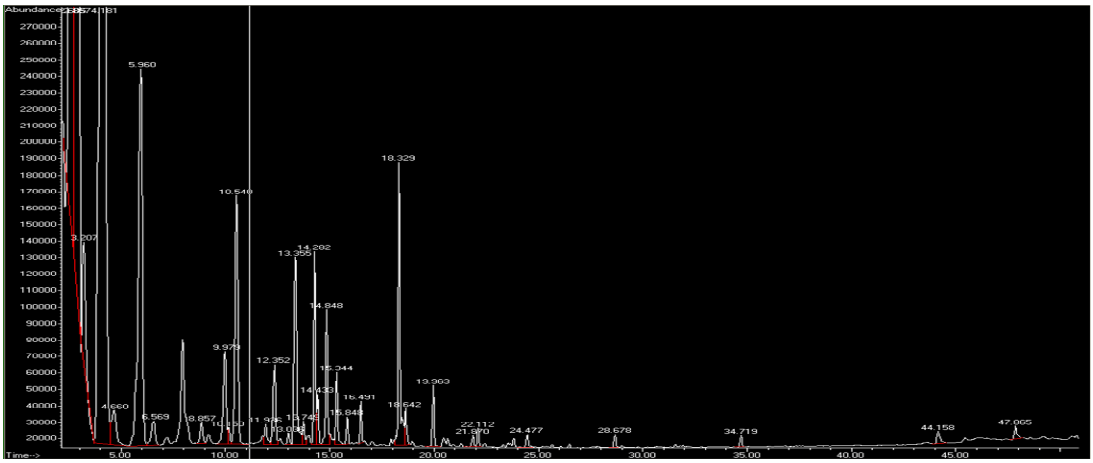


Figure 5. Gas chromatograph for Italian black truffle oil.

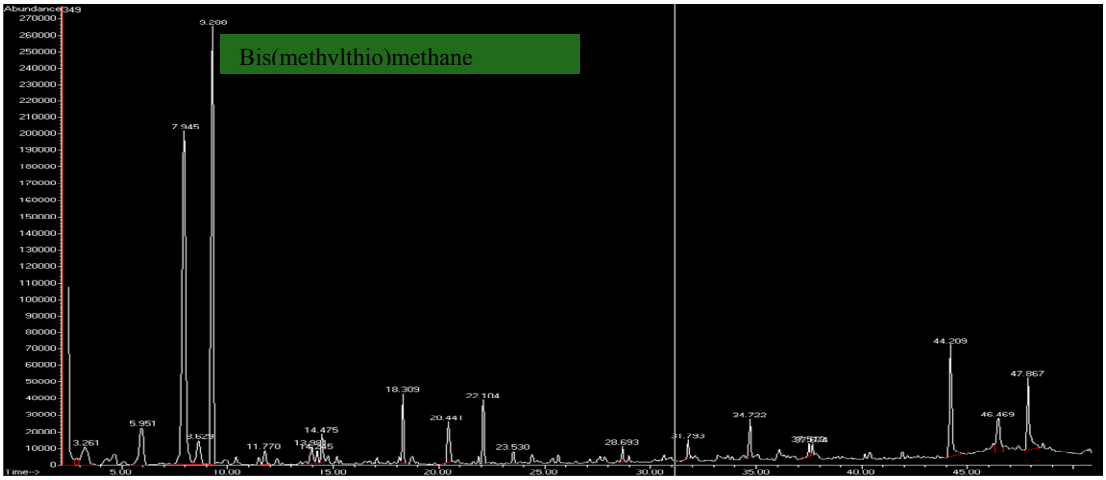
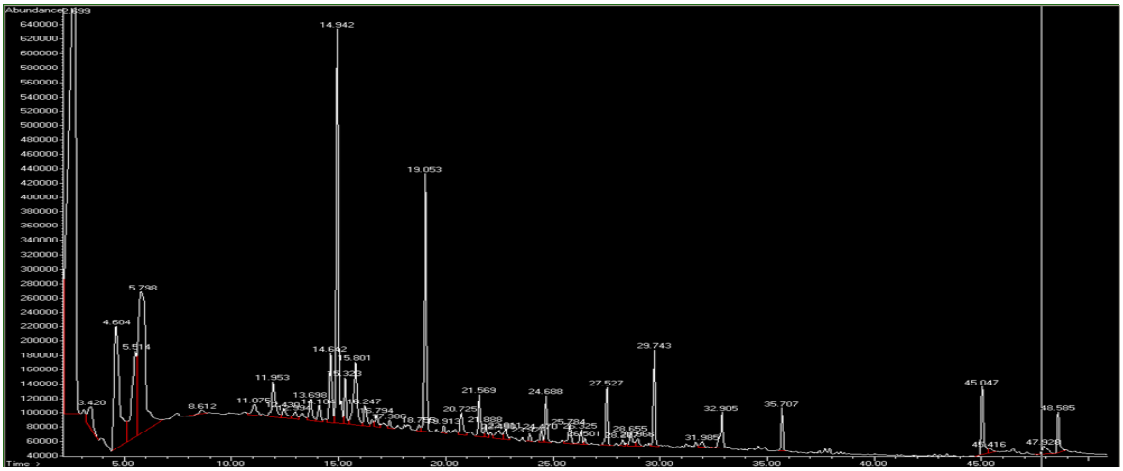


Figure 6. Gas chromatograph for fresh *Tuber lyonii*.



Goals and Outcomes Achieved

The long-term goal was to increase the number of truffle producers in Texas from zero (0). The project team has made progress by working closely with at least 25 growers at their farms. Information was shared directly with more than 500 members of Texas Pecan Growers Association and with members of Georgia Pecan Growers Association. Electronic media were distributed via YouTube, http://www.youtube.com/watch?v=CE1rrj-G1Wc.

As a result of these efforts, growers and homeowners from Texas, Arkansas, Oklahoma and New Mexico have contacted the project team to express interest in truffle production. They also have sent samples of fruiting bodies from their orchards or backyard trees.

Team members conducted four meetings during the project period as planned at the beginning of the project. These meetings were utilized for project planning and discussion on next steps.

Project staff was not able to assess the additional 2 species for production practices because of a very high cost of inoculum. Fresh truffles of the species that staff did not collect themselves or obtain from colleagues within the United States were not justifiable in the budget. Instead staff used a larger number of plants / treatments for T. lyonii. Staff also realized they could impart the knowledge on handling and growing inoculated pecan seedlings to other systems. Ensuring growth of healthy, inoculated pecan seedlings in this system was a significantly educational experience. From stratification to growing seedlings in sterilized medium before and after inoculation, all steps required careful preliminary tests before experiments could be set up.

Cost-benefit analysis was not possible even though we tried it the few data. While the pecan field day connected to this activity was not conducted because of reasons including drought and the subsequent change in the plan for field projects. During the Texas Pecan Growers Association conference, staff conducted a survey to assess the interest of pecan growers and managers in a collaborative effort. 25 percent of the respondents are interested in us visiting their orchards to locate truffles. Those that expressed this interest also voiced support for using inoculated trees for plantings in the future.

Beneficiaries

Approximately 300 pecan growers in Texas, and more than 250 truffle growers in the US and in Europe, over 50 truffle dog handlers, general public, next generation of educators (via student training), and U.S. agriculture. Beneficiaries represent several states in addition to Texas, including Arkansas, Florida, Georgia, Maryland, North Carolina, New Mexico, Oklahoma and Oregon. The last reported value of pecan truffle being sold in New York was at $400/ lb instead of the $100-200 that was estimated. While this may not be a direct result of the work only in Texas, but staff collaborations with Georgia, North Carolina, Florida and Oregon has helped increase the interest in this specialty crop nation-wide.

Lessons Learned

Drought is greatly impacting agriculture in the United States, especially in Texas. In light of this, it is even more apparent to help growers establish additional sources of income. Specialty crops that can be co-cropped, such as truffles, are even more important under the changing climatic conditions. Staff modified their plan and conducted controlled environment studies instead of conducting field studies to assess pecan truffle inoculation. In retrospect, this was a wise decision because it was not until summer 2012 that Texas received precipitation that might be considered somewhat normal, although the deficit from past years remains.

Staff observed large-scale death and destruction of pecan trees in the field due to drought stress. Even with supplemental irrigation (although limited under drought conditions), many growers lost many mature trees. Planting or inoculating trees under such circumstances would certainly have failed and would have led to wasted resources. Instead our greenhouse experiments have yielded reliable results under controlled environment conditions to allow growth analyses. Additionally, collaborations with researchers in other states in the southeast helped us obtain inoculum during the drought period.

The economic analyses depended on locating orchards with fruiting bodies earlier in the season, again the drought impeded this objective. Overall, it is remarkable that we have by now located pecan truffles in Texas pecan orchards. Project staff is highly encouraged to take this project forward and so are our industry partners.

The importance of utilizing truffle dogs was confirmed during the project period. While the truffle dog was not original included in the grant proposal budget, project staff sought a budget revision from the Texas Department of Agriculture. This budget revision was less than 10 percent of the total project. The truffle dog assisted surveys helped locate truffles in very large orchards where human searchers were unfruitful. Staff learned that pet dogs have been finding and eating truffles in backyards in Texas. Therefore, there is high potential for training truffle dogs. It does not seem that they need to be of a certain breed.

DNA studies are extremely useful in locating and testing trees that are already hosting the truffle fungi. This will also help test the nursery stock for checking whether the pecan trees already have the fungus when they are planted.

Inoculated pecan seedlings grown in containers require very specific growing conditions which differ from field production of seedlings. The project team has developed a growing system for Texas cultivars through this project and this is a significant advancement for truffle production.

Additional Information

Industry partners have been supportive of this project and several pecan growers are working with the project team very closely. Awareness and interest in pecan truffles is increasing as a result of this project. Growers are keenly interested in more information. Please see below the publication list from this project. Co-authors include industry partners and academic researchers and educators from across the U.S.

Publications:

Sharma, J, BC Trela, S Wang*, ME Smith, and GM Bonito. 2012. Pecan Truffle (*Tuber lyonii*) in Texas. Pecan South, December: 16-24.

Smith, M., G. Bonito, J Sharma, J. Long, B. Davis-Long, and T. Brenneman. 2012. Pecan truffles *(Tuber lyonii):* what we know and what we need to know. Georgia Pecan Magazine, Spring: 52-59.

Electronic Media:

Jacobson, K and J Sharma. 2012. YouTube video on pecan truffle project. 20 October. http://www.youtube.com/watch?v=CE1rrj-G1Wc

Presentations:

Sharma, J and S Wang*. 2012. Pecan Orchards: Fertile Ground for Co-Cropping with Truffles? Texas Pecan Growers Association 91st Annual Conference and Trade Show. 18 July. San Marcos TX.

Sharma, J and S Wang*. 2012. Pecan Truffles in Texas. Texas A&M AgriLife Comanche County Extension Meet. 19 July. Comanche, TX.

Smith, ME, GM Bonito, ZW Ge, J Sharma, and TB Brenneman. 2013. Exploring the potential of co-cropping the Pecan Truffle (*Tuber lyonii*) with Pecan (*Carya illinoinensis*) in the Southeastern US. 1st International Congress of Trufficulture. Teruel, Spain.

*asterisk indicates graduate student.

PROJECT 14: TEXAS STATEWIDE DIAGNOSTIC PROGRAM FOR THE POTATO PSYLLID AND EVALUATION OF BEST MANAGEMENT PRACTICES TO MINIMIZE ZEBRA CHIP DISEASE IN POTATOES

Partner Organization: Texas A&M AgriLife Research - Weslaco
Project Manager: Dr. Donald C. Henne
Contact Information: DCHenne@ag.tamu.edu
Type of Report: Final
Date Submitted: March 2013

Project Summary

Zebra chip (ZC) disease is a serious concern to potato growers in Texas. The pathogen causing ZC is vectored by the potato psyllid, is readily transmitted, and is noncurable. Growers are increasingly reliant on timely information about psyllid activity and potential for infecting plants with ZC before potato planting, and throughout the course of the potato-growing season. This information is critical for pest management decision-making, and also provides feedback on management practices and pesticide efficacy. In addition, frequent laboratory and field trials are necessary to test current and prospective insecticide chemistries and rotations for potato psyllid management, so that growers have a knowledge base from which to formulate their psyllid management strategies.

Project Approach

Potato growers in the major potato growing regions of Texas (Lower Rio Grande Valley (LRGV), Pearsall, and the Texas Panhandle) were contacted and arrangements were made to have commercial potato fields sampled and have samples shipped weekly to the Subtropical Pest Management Laboratory (Texas A&M AgriLife Research) in Weslaco, Texas. Personnel were hired to perform sample processing and counting, and equipment (microscopes, coolers, sticky traps, etc.) were purchased. Field plots (untreated controls - 3 x 0.33 acres) were planted at the Texas A&M AgriLife Research - Weslaco experiment station during December 2011 and January 2012 to serve as comparisons with commercial grower fields in the Lower Rio Grande Valley. Similar plots were also established at Pearsall and Olton, Texas. Adult potato psyllids were shipped to Prosser, Washington for polymerase chain reaction (PCR) diagnostics to determine infectivity levels of psyllid populations. Information from field counts and PCR results were collated and reported every Friday to potato growers, colleagues and chemical company reps (>180 people).

Insecticide trials were also initiated at the Weslaco experiment station, and field trials were performed from January to May 2012. Laboratory bioassays were performed on a range of selected insecticides from June to November 2012.

Goals and Outcomes Achieved

Forty-two weekly reports were issued by email to growers, scientific peers, students, and industry representatives. Texas potato growers expressed substantial interest in the weekly psyllid report. Those growers in the Texas Panhandle were well prepared for this year's activity, in response to the unusually high psyllid populations that developed to the south in

the LRGV and Pearsall. In addition, requests for additions to the list came from potato growers in Nebraska, Kansas, Colorado, North Dakota, Minnesota, Wisconsin, Washington, Idaho, and Oregon. Therefore, there is broad regional and national interest in the results and information coming out of Texas potato psyllid monitoring effort. The psyllid reports were also posted and archived on the SCRI zebra chip website:
zebrachipscri.tamu.edu/resources/potato-psyllid-survey-report-archive

Numerous other zebra chip researchers who required live and/or preserved psyllids for their research broadly utilized material obtained from these surveys. Additionally, a comprehensive picture will eventually emerge about how psyllid populations behave and are structured over spatial and temporal scales.

With respect to best management practices, staff discovered evidence of psyllid resistance to organophosphate and carbamate insecticides. Some issues with other chemistries (i.e. pyrethroids and neonicotinioids) are also emerging. There is a critical need to determine the extent of this resistance, as the number of available tools for growers to use is shrinking. Therefore, growers in Texas and elsewhere benefitted greatly from this knowledge so that they can make practical economic decisions in how they design their potato psyllid management programs. The current number of insecticide applications averages 8 or more per season. A future goal is to eventually reduce this amount by half.

Potato psyllid and Liberibacter diagnostic information was used by potato growers to plan ahead for their psyllid management approaches, and to respond to current threats. If psyllid populations were not expected to be present, were present in very low numbers, or Liberibacter was absent from the psyllid population, then growers would be able to make decisions about what insecticide(s) to use, or decide not to spray if not warranted. The current recommended approach is to use in-furrow seed treatments, followed by early season targeting of adults before they establish, followed by maintenance of population suppression with systemic insecticides as the crop matures. We are currently evaluating new insecticide chemistries and sequences of chemistries, and this information is made available to the potato growers at the annual zebra chip reporting sessions.

Beneficiaries
Potato growers, scientists, students, and industry partners in Texas and other states benefitted from this information. As described above, more than 180 recipients of the weekly psyllid reports benefitted from the information obtained from this project. Growers, in particular, benefitted from this information, as it provided feedback on their management practices, which they modified as needed. Industry partners also received feedback on efficacy of their products.

Lessons Learned
In addition to the science, it is important to understand the administration of the grant and work with the university to ensure funds are available when awarded by the Grantor. Time and money can be lost if there is miscommunications.
Additional Information
None

PROJECT 15: POMEGRANATE COLLABORATIVE FOR THE PRESIDIO VALLEY

Partner Organization: La Junta Heritage Center
Project Manager: Teresa Noyes
Type of Report: Final
Date Submitted: January 2013

Project Summary
This project's long term goals were to re-invigorate the local agricultural economy and heritage of the Presidio Valley and bring fallow fields back into production by demonstrating the feasibility and economic benefits of growing, processing and marketing pomegranates.

Activities accomplished under this grant include:

- Establish a one-acre testing site to determine pomegranate variety, viability, and yield.
- Partner with Dr. Jaime Iglesias of Texas A&M AgriLife Extension in El Paso to establish varieties and test site.
- Conduct work weekend as opportunity to interact and involve surrounding community of landowners and growers to discuss pomegranate potential in area.

Project Approach
Dr. Iglesias provided consultation for LJHC to guide decisions in the following areas, and ensure the optimal yield:

1. Test site recommendation based on property coordinates (latitude/longitude), and cross-referencing them with his soil sample repository.
2. Tree variety
3. Tree sourcing
4. Planting plan – spacing, depth, time of planting
5. Irrigation system design
6. Crop protection from animal damage
7. Maintenance expectations

Project activities include:

- Established meeting schedules for project timeline
- Website created for communication, outreach, regional history, and future work. It served as communication device to establish long term collaboration efforts with larger community of growers, area residents, and potential donors.
- Established baseline field conditions and marked plot
- Secured electricity drop from AEP
- Established water needs and source
- Installed holding tank, water lines, and pump
- Obtained soil samples
- Obtained agriculture materials from donations and re-use from site
- Trained and coordinated volunteers and laborers

- Obtained 604 pomegranate trees
- Installed timed drip irrigation
- Installed electric fence
- Established management schedule for plot monitoring
- Solidified community engagement

As of October 2012, 604 pomegranate trees had been planted in the test acre, watered twice weekly for the first month, and as needed thereafter. Staff currently monitors for disease, predation, and water use. Staff will take a baseline measure of yield in February 2013.

Difference between initially stated goals and achievements

1. Achieved work plan task for first six months in the second six months
2. Records for physical soil and water quality test are not yet established
3. Surrounding growers are interested in the progress and are observing the project
4. The center has not yet hosted pomegranate field days, technical information sessions for area farmers regarding pomegranate growth. Therefore, the associated survey was not conducted.

Goals and Outcomes Achieved

Below are the goals and outcomes achieved by La Junta Heritage Center during project lifecycle.

1. Established a monitor pomegranate plot of one acre in Presidio Valley.
2. Collaboration with Texas A&M AgriLife Extension Service.
3. Conducted four work weekends. Staff provided field information session for volunteer planters and visiting Presidio residents.
    - Site cleanup and prep
    - Planted 604 pomegranate trees on one-acre monitoring field
    - Drip irrigation system designed and installed
    - Electric fence constructed to ward off feral hogs

Beneficiaries

The project benefits the La Junta Heritage Center board of directors, approximately 30 volunteers from the surrounding region and state who contributed time to the planting and were educated in pomegranate planting and cultivation techniques, and about 20 local farming families who are the potential recipients of the knowledge and technical information base being developed as a result of the planting. As the plants mature, these farming families will be educated and informed about the progress of the crop, and trained in the field on pruning, irrigation and care of the pomegranates. These farm families may be interested in growing pomegranates once cultivars have been isolated and management practices documented. In addition, there is the possibility of establishing more sustainable practices that will adapt old irrigation infrastructure to allow for drip irrigation on acreage dedicated to pomegranate production.

There are currently about 3,700 acres of existing fallowed land in the Presidio Valley that could likely be put to use growing pomegranates, resulting in a potential future net economic benefit of $18.5 million directly to families in the area.

Lessons Learned

1. A detailed project schedule for physical work is needed to stay on track
2. An established planting plan regarding time, spacing, depth, and irrigation design helped in coordinating volunteers
3. Website, social media, and word of mouth used together created a large and energized volunteer force.

Additional Information

KLRU Episode for work weekend http://www.klru.org/artsincontext/episode/la-junta/
http://lajuntaheritage.org/
http://marfapublicradio.org/blog/talk-at-ten/lajunta/

PROJECT 16: MONTOPOLIS COMMUNITY MARKET ASSESSMENT

Partner Organization: Ecology Action
Project Manager: Ashley Hicks, (512) 321-0000
Type of Report: Final
Date Submitted: January 2013

Project Summary
In 2010, Ecology Action (EA) acquired 9.8 acres and founded Circle Acres Farm in the urban heart of Austin's Montopolis Neighborhood, where the Table to Table Project was launched. Organic waste collected from local residents and area restaurants through a composting operation were delivered to Circle Acres, where it was processed into soil to eventually be applied to specialty crop production gardens. It is the intention of Circle Acres to increase access to affordable, nutritious produce in the under-served Montopolis neighborhood, while providing this community with "hands on" food systems and environmental education opportunities.

Numerous factors have indicated the existence of a food distribution bottleneck in the area, a generalized obstacle to consumer access. Additionally, nutritional literacy appears to be a prohibiting factor. The Table to Table Project proposed to evaluate area-specific approaches to specialty crop distribution and engage the community in nutritional education through a one-year community market assessment. In addition to determining Table to Table's specialty crop distribution strategy, evaluation of this process will be documented and compiled into a handbook designed to assist other producers in strategic market assessment.

Project Approach
During the past year Ecology Action conducted 200 surveys, 4 community focus groups, 6 youth classes, and attended 8 community outreach events in the Montopolis community in order to assess food accessibility and the market for specialty crops. The initial project goals were to establish community partnerships, prepare focus groups and educational opportunities in the community, gather community input on specialty crops, and further the knowledge within the community. EA spoke with over 200 residents and families of Montopolis about how they source their food, what barriers they encounter in accessing fresh food, and whether Circle Acres distribution strategies are applicable to their community.

Ecology Action's survey data revealed that 80 percent of Montopolis residents purchase fresh fruits and vegetables outside of the community. Many survey participants disclosed that the only local grocery store in the community, the Tomgro Market, did not provide the freshest produce options for their family. Only 6.5 percent of participants considered the Tomgro to be a significant source for their food needs. As far as the concern about barriers to specialty crops, 37.5 percent of residents recorded that cost and location were prohibitive factors. A lack of knowledge on how to prepare fruits/vegetable and prepare them well followed with 36 percent and 32 percent. Only 6 percent of participants responded that their families did not consume specialty crops at all and 19 percent attributed zero barriers to their access of fresh produce.

Ecology Action learned that 61 percent of the surveyed population had never been to a farmer's market, with 4 percent stating they had attended seldom. However, 54 percent of informants said they would most likely shop at a farmer's market in Montopolis. Furthermore, 37 percent and 47.5 percent of participants reported to be somewhat and very likely to subscribe to a community shared agriculture (CSA) which provided fresh fruits and vegetables.

Goals and Outcomes Achieved

In 2010, Ecology Action (EA) acquired 9.8 acres and founded Circle Acres Farm in the urban heart of Austin's Montopolis Neighborhood, where the Table to Table Project was launched. Organic waste collected from local residents and area restaurants through a composting operation were delivered to Circle Acres, where it was processed into soil to eventually be applied to specialty crop production gardens. It is the intention of Circle Acres to increase access to affordable, nutritious produce in the under-served Montopolis neighborhood, while providing this community with "hands on" food systems and environmental education opportunities.

This specific assessment helped surpass the initial goals of 80 percent, to 84 percent of participants reporting increased awareness and further interest of specialty crops. Most significantly, when asked what concerns would need to be addressed if these options were made available in the neighborhood, 51 percent of contributors said they were concerned with affordability, while 29 percent told us that a convenient location was also paramount.

Ecology Action was able to conclude from the 20 focus group participants that specialty crops were difficult to access because of transportation and financial issues. One participant emphasized the difficulty in choosing specialty crops when faced with a fixed income and how "you end up trying to supplement your diet with non-protein items that are less healthy, but affordable." Many participants revealed that they were interested in being educated on how to incorporate healthier practices into their households, as well as how to include diverse specialty crops into their diets in a culturally relevant way. After tasting some of the sample specialty crop dishes we made as part of the food demonstration, many people expressed interest in wanting to learn about healthier substitutes for foods they already prepared well.

A majority of the participants were interested in a community based approach to their food needs, which includes a cooperative community shared agricultural model (CSA), healthy educational youth programming, and engagement with the elders of the community and their food experience.

In conclusion, we were able to discern that Ecology Action's proposed distribution strategy of a specialty crop farmers market would best address the Montopolis community needs and desires. The majority of participants expressed the distinct interest to see a farmer's market within the area. All of the youth participants thought that they might respond to specialty crops differently if they had a better hands on relationship, knew how to grow them well, and if they were made affordable.

The initial project goals were to establish community partnerships, prepare focus groups and educational opportunities for the community, gather residential input on specialty crops, as well as further the knowledge within Montopolis, of which Ecology Action achieved. Additional goals included increasing organizational knowledge of specialty crop consumer behaviors and increasing consumer literacy regarding specialty crops in East Austin, which were also met, but that could be furthered by more intensive research.

Beneficiaries

In addition, the focus groups resulted in partnerships amongst community members, organizations, and Ecology Action. Urban Patchwork and The Sustainable Food Center, two organizations that also work on food accessibility, have begun collaborative projects with Ecology Action as well as Montopolis residents around specialty crop production. Furthermore, the Montopolis Recreation Center and the Montopolis Health Center are both interested in hosting CHOICES, a nutritional and garden literacy series of classes and demonstrations that are free to the low income public, and organized by the Capital Area of Food Bank organization of Central Texas. In addition, this assessment has rejuvenated current upkeep and winter bed preparation of the Montopolis Health Clinic's community garden, which was not in use when researching of this project began.

Ecology Action has greatly benefitted as a result of this opportunity and access to this invaluable data. It has influenced the programmatic visions of Circle Acres in conjunction with the general interest from the organizations participants. Ecology Action looks forward to developing the project further and working more cooperatively with the residents and organizations of Montopolis, as well as the greater specialty crop distributor community who have all benefited from this assessment.

Lessons Learned

Ecology Action recommends that as this work develops, outreach efforts should continue in order to bring more of the community into the project. Although researchers made many connections with community leaders and neighborhood association members, there is still work to be done to develop rapport amongst all neighborhood stakeholders.

PROJECT 17: PAPAYA: A NEW SPECIALTY CROP TO ADD VALUE AND DIVERSIFY THE FRUIT INDUSTRY IN TEXAS

Partner Organization: South Texas Fruit and Vegetable Growers
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Type of Report: Final
Date Submitted: March 2013

Project Summary

The fruit tree industry in South Texas is currently dominated by one species – citrus, despite the fact that many other high-value specialty fruit crops can also be produced in this subtropical climate. Such a narrow crop base makes the industry highly vulnerable to numerous threats such as freezes and emerging diseases such as citrus greening. Diversifying the crop resource base can minimize such negative impacts and increase profitability and sustainability. The goal of this project was to assess the feasibility of enhancing commodity diversity in the south Texas fruit industry by introducing papaya (*Carica papaya* L.) as an alternative specialty orchard crop. Specifically, staff evaluated the performance (growth, earliness, fruit yield, fruit quality, and stress tolerance) of diverse papaya varieties and fruit types (large, medium, or small) under south Texas conditions. Investigations were carried out during the 2012-2013 growing season, and high-performing varieties based on tree growth, earliness, fruit yield, fruit quality, and stress tolerance were identified and recommendations made to interested growers who planted initial fields ranging from half an acre to nearly five acres. This new commodity is expected to benefit both conventional and organic growers with existing packing/processing facilities by expanding the volume and season of operations, and also by adding value to their operations in terms of a unique new product line. Staff continue to monitor established fields under grower conditions and are making additional assessments of fruit yield, quality, and responses to production inputs and environmental factors particularly drought, heat and cold temperature stress, nutrition, and diseases.

Project Approach

Germplasm screening for adaptability and productivity involved twelve conventionally-bred papaya varieties obtained from a commercial seed source (Golden Valley Seed Co. El Centro CA; Table 1). Diversity among the varieties screened spans the different fruit sizes, fruit shapes, flesh color, and eating quality properties. Seeds were primed and germinated in tree seedling containers (Stuewe and Sons, Inc., Tangent, Oregon; Figure 1A, B) in a heated greenhouse. Eight week old seedlings were hardened outdoors and transplanted in field plots in April 2012 in Weslaco, TX (Figure 1C). Trees were planted at 6 x 6 ft spacing between trees in double tree rows that were 12 feet apart. Five trees of each variety were planted in

each plot and plots were replicated three times. The rows comprised raised beds covered with plastic mulch and surface or subsurface drip irrigation systems. The experimental site was moderately well drained (Hidalgo sandy clay loam soil). Wind breaks were also established to protect seedlings from desiccating winds during establishment. In addition to the intensive screening field site in Weslaco (Lower Valley), trees were also planted in Rio Grande City, Texas (Upper Valley), and in Mission, Texas (Mid Valley) in a commercial field managed by a partner organization (South Tex Organics) (Figure 2). Additional field plantings have recently been established by cooperating growers in Edinburg, Texas, and more are planned for the lower Valley near Brownsville. Growth and development data recorded for each variety included: rate of development from transplanting till first flower and fruit set, tree height at first flower, trunk diameter, number of leaves at first flower, canopy width (leaf span across row), number of fruits per tree, fruit size (medium, small, large), fruit shape (round, oblong), fruit flesh color, flesh (edible mesocarp) thickness, fruit flesh firmness, internal cavity seediness, flesh smell, and marketable fruit yield per tree.

Tree development during spring and summer months was generally fast. At planting (April) seedling heights ranged from 6 to 10 inches and by the time of first flower bud expansion (August), average tree height was 5.5 ft (range: 4.5 – 6.5 ft) (Figure 2). Warm weather conditions and adequate irrigation/nutrition during this vegetative growth period were essential to hasten development towards flowering and fruiting. Because papayas are fast-growing plants, attempts were made to supply amply irrigation and balanced nutrition. Shortly after transplanting, trees were initially fertigated with a 5-26-3-3 liquid/acid fertilizer once every two weeks for the first 2 months after transplanting. Thereafter, trees were fertigated with a balanced complete nutrient fertilizer (20-20-20) until flowering. During fruit development, trees were fertilized alternately with 3-18-18 (fertigation) or 0-0-25 (foliar).

Two varieties namely Red Maradol and Known You #1 flowered much earlier (5 months after planting) than the rest of the entries (Table 2). All other varieties generally flowered 2 to 4 weeks later than these two. Red Maradol and Known You #1 were also generally dwarf trees (1.67 and 1.68 m tall respectively) compared to the other varieties (1.7-2.7 m tall). The first fruits formed on Red Maradol and Known You #1 trees were approximately 0.74 and 0.8 m from ground level.

A significant difference between Red Maradol and the rest of the varieties was also observed in the ability to set fruit under high temperature stress conditions (≥ 90 °F). While warm temperatures accelerated development and early flowering, fruit set was severely limited by heat stress in all the varieties screened, except for Red Maradol which appeared to be quite tolerant to this stress. Red Maradol is a medium-sized variety with red flesh and moderate sweetness (10° Brix). For the other varieties, pistillate flowers initiated during this heat-stress period generally aborted. Later in the season (September), with abatement in air temperature and heat stress, fruit set percent increased dramatically, however, many fruits set on bisexual plants under heat stress conditions were misshapen (Figure 3). Heat stress appeared to induce changes in flower type in bisexual trees and market quality of fruits. Fruits set on pistillate plants did not show any heat stress-related deformity as those formed on bisexual plants. Over 90 percent of fruits formed on pistillate trees were marketable fruits with normal shape and size compared to only approximately 60 percent for fruits formed on bisexual trees. A

higher percentage normal marketable fruits were set much later in the season October-November) when temperatures were optimal for pollen germination, fruit set and development (Figure 3B). Fruit maturity (breaker stage) appeared first on Red Maradol trees in mid-November. Fruit development and maturation rates were similar among the other varieties, except for Waimanalo, which was slightly late in fruit set (~2 weeks) and maturation. Fruits that were set in late November and December grow very little. Due to the relatively mild winter during 2012-2013 (lowest temperature, 38° F), trees and fruits were not impacted by cold temperatures. The number of fruits per tree varied from average of 27 to 91 but had no distinct correlation with fruit size (small, medium, or large) (Table 2). Average fruit mass ranged from 315 to 509 g for small fruited varieties, 600 to 1,100 g for medium fruited varieties, and 1,200 to 2,100 g for large fruited varieties. The average cumulative fruit yield per tree from periodic harvests between December 2012 and March 2013 ranged from 25.6 to 143.5 Kg and did not seem to correlate with fruit size (small, medium, or large). Fruit quality assessed in terms of total soluble solids (TSS) concentration was highest in earlier harvests (11-16 percent in December fruits harvests) than in the early spring harvests (7.7 – 10.1 percent in March). The TSS values were seemingly a function of fruit load at time of harvest. In these initial screening investigations, trees were not subjected to manual fruit thinning. Fruit thinning a common commercial practice aimed at improving fruit quality of retained fruits.

Warm weather conditions facilitated rapid tree establishment and development towards early fruit production. Each variety had unique characteristics that would fit a different niche specialty market segment either for small-scale Farmers' Market production or large-scale commercial production. Further studies are required to determine adequate timing of seedling transplanting to avoid periods of heat or cold stress during flowering and fruit set. In an earlier trial whereby trees were transplanted in July, fruit set occurred in early spring and mature fruits were ready for harvest in early summer. With late summer/fall planting, there is always a risk of freeze damage, however trees planted on raised beds with mulch seemed to have suffered less damage than those planted on bare ground.

The commercial practice of planting three seedlings per hill and thinning to one tree after flowering remains a costly activity. One strategy to minimize this cost is to produce rooted cuttings from known bisexual (productive) trees or to graft scions collected from such trees on vigorous rootstocks. Researchers are currently propagating candidate rootstocks to investigate the feasibility of these strategies. Five wild species related to cultivated papaya are being propagated for these investigations and include: *Vasconcellea gouotiana, Vasconcellea parviflora, Vasconcellea pubescens, Vasconcellea quercifolia, and Vasconcellea stipulata*. These species are believed to have good tolerance to many biotic and abiotic stresses such as chilling stress. Researchers also plan to explore the feasibility of propagating seedlings of known bisexual trees using micropropagation techniques to achieve similar goals. No major disease problems were observed during this screening; however preventive pest and disease management practices are recommended to keep trees vigorous and productive.

Goals and Outcomes Achieved
Adequate data was collected to demonstrate the feasibility of successfully producing papaya under the subtropical weather conditions in South Texas.
Goal 1: Identifying early, productive varieties: Varieties with desired maturity levels were identified and shown to be productive under South Texas growing conditions. Fruit production levels were comparable to those in major production areas such as Hawaii and Mexico. At least 11 growers have committed to establish or have already planted papaya orchards in the Lower Rio Grande Valley as a direct outcome of this project (Figure 5).

Goal 2: Improving plant vigor and disease tolerance: By combining the benefits of water-saving technologies (drip-irrigation), balanced nutrition, and efficient orchard floor management (mulch-covered raised beds), it was possible to grow vigorous, disease-free trees and obtain economic yield levels. The average cumulative fruit yield per tree from periodic harvests between December 2012 and March 2013 ranged from 25.6 to 143.5 Kg The data has been presented at grower field day events and workshops and has been extremely well received. Staff is still working on compiling a papaya production factsheet for stakeholders (growers, homeowners, and extension personnel) as well as a scientific publication.

Project personnel continue to make frequent field visits and consult with interested/participating growers to advise on cultural procedures such fertilizing, irrigation, and pest control (Figure 6). Two field demonstration days were conducted on December 14, 2012 and February 25, 2013. An Alternative Orchard Crops Workshop and field demonstration, featuring Papaya production has also been scheduled for March 21, 2013. This workshop is being conducted in conjunction with the Sustainable Agronomic Education Association and will target Citrus Growers, Master Gardeners and Emerging Growers in the Lower Rio Grande Valley. Attendees included large-scale growers (with potential/interest to establish >10 acres of papaya orchards) as well as small-scale growers and homeowners (<10-acre potential).

Beneficiaries
Ultimately, this project aims to increase diversity in the portfolio of specialty crops for the Texas fruit industry. This industry is dominated by low-input growers with limited production resources. This project will impact these high-risk producers by adding value to their operations in terms of a unique new high-value product line. This new commodity will benefit both conventional and organic citrus fruit growers with existing packing/processing facilities by expanding the volume and season of operations, and hence, profitability.

Lessons Learned
Even though enough data was compiled to make informed assessments of the feasibility of growing papaya in South Texas, multiyear evaluations are needed to evaluate the impact of production risks and constrains such as extreme freeze events on production. Multiyear data are needed for a comprehensive analysis of the economic feasibility of a sustainable papaya industry in South Texas. Multiyear trials are also needed to determine production input requirements (water, fertilizers, pest/disease management) for each variety and production field.

Additional Information

Staff would like to thank participating growers: Mr. Denis Holbrook, South Texas Organics, Mr. Boon LaGrange and Kenny Anderson of the Heritage Group, Rio Grande City, Texas, Dr. Mani Skaria, MicroTech, LLC, Hargill, Texas, Mr. Baudelio T. Chapa, of Providencia Fresh, McAllen, Texas, Mr. David Peterson of Super Starr International, L.L.C., Mission, Texas., and Mr. Alfredo Rodriguez, Mr. Andres Cerda and Mr. Daniel Avilla of Texas A&M AgriLife Research, Weslaco for their tireless efforts and devotion to this project. Mention of trade names or commercial products is solely for the purpose of providing specific information and does not imply a recommendation or endorsement by us, USDA or TDA.

Table 1. Fruit characteristics of Papaya varieties screened for growth, fruit yield, fruit quality, and stress tolerance in Weslaco, south Texas during the 2011-2012 growing season.

Variety	Size category	Flesh Color
Sun Gold	Large	Yellow
Gold Maradol	Large	Yellow
Waimanalo	Small	Yellow-Orange
Red Maradol	Medium	Red
Red Queen	Large	Red
Sunset	Small	Red-Pink
Sunrise	Small	Red-Pink
Tropical Red	Small	Red-Orange
Tainung #1	Medium	Red
Known You #1	Large	Yellow
Tainung #2	Medium	Red
Bella	Medium	Red-Pink

Table 2. Variation in tree and fruit development characteristics among twelve papaya varieties screened in South Texas during the 2012-2013 growing season, Weslaco, TX.

Variety	Earliness Index	Height of first fruit, m	Tree Height, m	Fruit Yield/tree, Kg
Sun Gold	Early	1.09	2.24	85.8
Gold Maradol	Early	1.40	2.43	78.4
Waimanalo	Late	1.46	2.28	27.9
Red Maradol	Very early	0.74	1.67	70.8
Red Queen	Early	1.07	2.12	86.5
Sunset	Early	1.03	2.11	25.6
Sunrise	Early	0.92	1.73	31.6

Tropical Red	Late	1.23	2.18	27.1
Tainung #1	Early	1.29	2.69	136.4
Known You #1	Late	0.80	1.68	45.1
Tainung #2	Early	1.35	2.75	73.6
Bella	Early	1.35	2.64	143.5

Table 3: Variation in fruit characteristics among twelve papaya varieties screened in South Texas during the 2012-2013 growing season, Weslaco, TX.

Variety	Fruit wt	Length	Width	Thickness		Fruit flesh color characteristics		
	Kg	cm			°Brix	Hue°	Value	Chroma
Sun Gold	1.48	21	13.6	3.1	7.7	2.2 y	6.0	7.0
Gold Maradol	1.29	17.6	10.6	2.8	8.5	2.2 y	6.6	3.2
Waimanalo	1.00	12.2	12.4	2.9	9.0	1.0 y	5.5	6.9
Red Maradol	1.84	22	12.9	3	7.9	6.0 yr	5.7	9.4
Red Queen	2.00	20.7	15.2	2.7	9.6	7.0 yr	5.6	7.5
Sunset	0.32	10.2	8.6	1.9	9.8	7.5 yr	6.0	8.1
Sunrise	0.51	13.4	8.5	2.3	10.0	7.4 yr	6.1	7.6
Tropical Red	0.45	13.6	8.4	1.8	10.1	6.6 yr	5.9	9.1
Tainung #1	2.15	24.7	15	3.5	9.2	6.3 yr	5.2	6.4
Known You #1	1.15	17.6	12..8	2.7	10.0	1.7 y	6.8	8.9
Tainung #2	0.81	22	9.6	2	9.3	7.7 yr	6.2	7.3
Bella	1.97	22.1	13.2	2.9	8.0	5.8 yr	5.5	8.1

PROJECT 18: INCREASING CONSUMPTION OF TEXAS WATERMELONS THROUGH TV AND ONLINE PROMOTIONS

Partner Organization: Texas Watermelon Association
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Project Type: Final
Date Submitted: January 2013

Project Summary

The project "Increasing Consumption of Texas Watermelons Through TV and Online Campaign for 2012" was a continuation of the 2011 campaign by reaching more consumers, allocating more funds in the Dallas and Houston markets and creating an on-line marketing campaign that targeted consumers with messages about the health benefits of Texas watermelons.

By utilizing 2011 TV creative "Watermelon Smiles" for TV and build an online campaign to reflect the creative, Texas Watermelon Association (TWA) was able to extend the use of the commercials created with the 2011 funds and save money. The purpose of the campaign was to build on current successes with in-store demonstrations, support local produce consumption in restaurants and tout the health benefits of eating fresh Texas watermelons. TWA was able to partner with the Texas Department of Agriculture and the Texas Vegetable Association to send the same message to consumers:

1) Purchase fresh Texas produce/watermelons at your retail grocery store;
2) Visit restaurants that purchase/serve local produce/watermelons; and
3) Tout the health benefits of eating fresh Texas produce at home, work or at a restaurant.

In addition to sending the same message to consumers, the overall goal of this promotion was to increase both consumer awareness and sales of Texas watermelons.

TWA utilized the funding available to buy airtime in the following markets: Austin, Dallas, Houston and San Antonio. The TV schedule was combined with online marketing and in store consumer demonstrations held at various retail outlets and restaurants in Austin, Dallas, Houston and San Antonio as well as print ads and event participation.

The TWA Project contracted with Marketing Matters, an Austin based advertising agency, was contracted to plan, negotiate and buy the TV schedules as well as develop a creative strategy for the 2012 campaign.

The marketing concept used for 2011 and 2012 was "Watermelon Smiles", which showed how Texas watermelon can make the whole family smile, especially moms, because Texas watermelons not only taste great but are also healthy.

Project Approach
In order to achieve the goals the project was divided into the following four areas:

- Television media buy
- Digital marketing
- Print ad & advertorial
- Event marketing – The Taste of Dallas

Television Media Buy: The television campaign included: 30,:15 and :10 second TV commercials. The target demographic was women (moms), 25-54. TV shows such as The Food Channel, HGTV, Oprah, Ellen and morning news were included in the media buy to specifically target the core demographic. The TV schedule was combined with in-store consumer demonstrations that were held at various retail outlets in the four markets. The campaign for TWA was executed in three different holiday flights: Memorial Day, July 4th and Labor Day and included a mix of television commercials, print advertising, targeted online ads and event marketing to reach the four major markets in Texas: Houston, Dallas, San Antonio and Austin. Below is a summary of the media purchased.

Digital Marketing: Marketing Matters placed banner ads and video pre-rolls of the TV commercial on KVUE.com in Austin, KHOU.com in Houston and NBCDFW.com in Dallas. The online ads on NBCDFW.com were part of an Independence Day special package that ran from 6/4/12 – 7/4/12. There were several special components included, such as a page skin that was featured on the homepage. The online ad creative reflected the same consistent message that was featured in the television commercials.

Print Ad and Advertorial: Together, with TDA, Marketing Matters created and placed an ad and advertorial in the trade magazine, The Packer. TWA's ad and advertorial were included, along with the Texas Vegetable Association's ad, in a special section that was dedicated to GO TEXAN and the Texas Department of Agriculture. The advertorial explained the marketing campaign and its positive effect on sales of Texas watermelon and invited retailers to contact both the Texas Watermelon Association and TDA to participate in retail promotions.

Event Marketing – The Taste of Dallas: The objectives were to uniquely align the GO TEXAN brand and the Texas Watermelon Association with a very reputable and tasteful food event featuring the best chefs, restaurants, artists, kid's activities and music in Texas. For the second consecutive year, Marketing Matters worked with the NBC television affiliate in Dallas and was able to secure the Texas Watermelon Association as a sponsor of the Taste of Dallas as added value for booking a television schedule on the station. TWA had center stage for the second year in a row with the production of the TWA Watermelon eating contest. The contest was promoted heavily on the NBC TV station in Dallas, on the NBC station website and throughout the Taste of Dallas on-site event with banners and posters.

Partner Organization: Marketing Matters partnered the TWA campaign with the Texas Vegetable Association /Southwest Dairy Farmers campaign as an overall media buy to maximize television, online and print media purchases for both Associations.

Goals and Outcomes Achieved

The goal was to increase awareness of the greater desirability of Texas watermelons over those grown outside the state, and increase sales of Texas watermelons. Typically, sales of watermelon during in store demonstrations increased an average of 120 percent (baseline). With the addition of the TV marketing campaign, TWA expected to see an increase in sales of 250 percent (target). The TWA and TDA worked with Texas watermelon producers and retailers to monitor sales during and after promotions (performance measure). The information gathered was compared to sales from the previous week before the event occurs to determine a percent increase in sales. Grower surveys indicated an average of 25 percent increase in sales of Texas watermelons. Texas retailers reported a 73.12 percent increase in sales of Texas watermelons.

Beneficiaries

In 2011, Texas producers harvested 21,000 acres of watermelons valued at $45M. These marketing events benefited more than 200 watermelon producers in Texas. Additional promotions impacted sales at more than 3,500 retail grocery stores, 150 Texas restaurants and resulted in more than 33 million television impressions.

Lessons Learned

With both state elections and presidential elections taking place, it was difficult and more expensive than anticipated to find the right spots at the right price.

PROJECT 19: RIO STAR ROUND UP-SPREADING THE SWEET LIFE ACROSS TEXAS

Partner Organization: TexaSweet Citrus Marketing
Project Manager: Eleisha Ensign, (956) 580-8004
Project Type: Final
Date Submitted: January 2013

Project Summary
The purpose of this project was to educate Texas school children in the largest Texas markets (Houston, Dallas, San Antonio, and Austin) and Texas media in Dallas and Austin on the health and nutrition benefits of Texas grapefruit. This was accomplished through

School Wellness Outreach: TexaSweet created an educational video and activity sheet designed to educate students in 2nd to 4th grades in the four target markets (Houston, Dallas, San Antonio, and Austin). Materials were made available to teachers in these markets and participating classes were entered to win a free shipment of Texas grapefruit or have a grapefruit party at their school for the entire grade.

Media Outreach: In Dallas and Austin, project staff sent fresh grapefruit, recipes and nutrition information to encourage coverage during the Texas Grapefruit season to media contacts.

Project Approach

1. Production and editing of Rio Star 101 kids video
    a. The script for the video was written to include the grove to plate story as well as nutritional information and easy recipes.
    b. The video was shot in November 2011 in the Rio Grande Valley for the grove segment.
    c. 5,000 DVD's were produced and can be viewed at: http://www.texasweet.com/party/
2. Development of materials for school wellness kits
    a. Developed a Kid's Activity Sheet and sent out 100,000 to the teachers encouraging students to complete and mail back to TexaSweet in order to be entered in the contest.
3. Developed contact lists
    a. We worked on developing a teacher contact list from the four target markets.

4. School Wellness Outreach
    a. Post Card - Designed a postcard with details of the program to mail out in January 2011 to 3,672 teachers in Austin, Dallas, San Antonio and Houston.
    b. Teachers visited the custom made website and filled in their contact information to participate in the program, view the program details and watch the video.
        i. 340 teachers visit the website and enroll in the program.

   c. Each teacher that filled out their information received a packet of materials containing a DVD of the video along with an activity sheet for each student.
5. The Activity Sheet was designed to accompany the video. Teachers were instructed to have the students watch the video, complete the activity sheet and then return the sheets to us to be entered to win free grapefruit.
6. Entries received back:
   a. Staff received 139 packages back from the teachers with over 4,292 activity sheets completed, a 42 percent return rate.
7. The Result: 22 boxes of fruit were mailed out to the winning classrooms and 882 students were able to taste Texas grapefruit through this program:
   a. 3 classrooms in each of the four target markets won a box of Grapefruit for their classroom.
   b. 10 classrooms outside of these four target markets won a box of Grapefruit for their classroom.
   c. 1 class in each of the four target markets won a grapefruit party for their entire grade. The party included an appearance by TC Cowboy, grapefruit sampling.
   d. The deadline to receive the entries was February 24, and the winners were selected the first week of March.
   e. A survey was conducted and some highlights are:
      i. 78.6 percent said the overall program was excellent.
      ii. 100 percent of the students liked tasting the grapefruit.
      iii. 71.4 percent said that all of the students enjoyed the DVD.
      iv. 92.9 percent of the teachers said that they would participate in a similar program with TexaSweet again, with the remaining 7.1 percent saying they maybe would.

Media Outreach: In January 2011, shipments of grapefruit were sent out to bloggers and media contacts in Austin and Dallas to encourage coverage of Texas grapefruit and continue to spread the important message about this healthy, Texas fruit.

Coverage to date:

- Hilah Cooking (2 posts, including one video)
- Houston Chronicle (print and online)
- Local Savour
- Tasty Eats at Home (2 posts)
- Twitter and Facebook impressions to date: 35,928

Total impressions to date: 3,352,855

Goals and Outcomes Achieved

The TexaSweet organization believes the goal to increase awareness about Texas grapefruit in school children and media in four Texas markets was achieved, although the survey yielded little information on previous knowledge of Texas grapefruit and prohibited staff from establishing a true benchmark. This lack of starting data further inhibits TexaSweet from determining the actual percent increase in awareness. As previously stated, responses from teachers and students was positive.

Beneficiaries
The program targeted schools in Houston, Dallas, San Antonio, and Austin. A postcard announcing the program was sent to 3,672 teachers in these markets. 340 teachers visited the website, entered to participate in the program, and received a packet of activity sheets for their students. By increasing consumers (students, teachers, parents, and media) more than 200 citrus producers in Texas benefit.

Lessons Learned
Limited participation in the program was disappointing. Every school in the target market was sent custom postcards in the qualifying grades. Facebook was also used to promote the activities.

Staff believes little information on previous knowledge of Texas grapefruit was difficult to collect in the survey because majority of the times the teachers that participated in the program wouldn't take the time to answer this question with their students. Also with this survey the project manager's experience historically has been, if the participants don't have an answer or any previous knowledge they typically skip the question, thus not yield data for the project.

The only negative comment received from the participating teachers was that they would have liked for each student that participated in the program to receive a grapefruit to taste. This is something staff will need to address in future programs, although total cost may make it prohibited.

PROJECT 20: A GARDENING NETWORK TO INCREASE THE SUPPLY OF FRESH PRODUCE FOR THE SAN ANTONIO FOOD BANK CLIENTS

Partner Organization: San Antonio Food Bank
Project Manager: Luz Myriam Neira, M.S., Ph.D
Email: lneira@safoodbank.org
Type of Report: Final
Date Submitted: June 2013

Project Summary

Food insecure families who rely on cheap, high calorie foods to avoid hunger and to supplement their food supply have increased the use of emergency food systems. Food banks in many cases provide the same high calorie dense foods to food insecure families. The low quality of food used by food insecure families put them at risk of overweight and obesity with women and children living below the poverty level particularly at risk. The purpose of the project was to increase the supply of fresh and healthful foods distributed by the SAFB by doubling the amount of fruits and vegetables produced by the community garden and by promoting the donation of surplus produce harvested by a network of family/community gardens. The San Antonio Food Bank (SAFB) assisted interested community organizations to build gardens so they could distribute directly to their clients.

The produce harvested at the SAFB garden and the surpluses of produce donated by the gardens in the network were distributed to the community throughout the network of 535 agencies. In addition clients receiving nutrition federal assistance were educated on how to use EBT cards at farmers' markets (FMs) to increase their access to healthy locally grown crops and hence improve their diets. Clients were directed to the FMs under the SAFB-Farmers' Market Association, where prices were kept competitive or lower than those at local supermarkets.

Project Approach

In order to improve the supply of healthy foods (fresh produce locally grown) available to the existing food emergency systems (535 agencies under the SAFB network as of 2012) the plan was to double the produce production at the SAFB garden and encouraging the donation of surplus produce harvested at family/community gardens. The SAFB agencies helping to fight hunger had to opportunity to take the fresh produce from the SAFB free of charge and make it available to the communities they serve. Another avenue to improve the access of fresh locally grown food was to educate individuals under the Supplemental Nutrition Assistance Program (SNAP) to use EBT cards at farmers' markets. Education was done through flyers distributed at classes, one-on-one sessions at the SAFB, FMs, health fairs and other community events. Important partners in the project were the members of the Gardening Network especially Trinity Church and the members of their congregation who volunteer their time and money to organize event such us the Transplants Give-Away.

Goals and Outcomes Achieved

1. Build community/school gardens over a period of one year. The idea was to build capacity of organizations to grow their own food with emphasis on specialty crops (fruits and vegetables) to improve the supply of healthy foods for food insecure families served by the SAFB network of agencies; in the process, the importance of growing your own food to provide adequate nutrition to both children and adults alike was instilled. A total of 18 organizations (14 community based organizations and 4 schools) requested services.

Twelve gardens were built and moved into production; three organizations are still interested and negotiations are in process; and two dropped out.

Another goal was to encourage donation of produce harvested to the SAFB. The target was to collect 3,000 pounds of produce from local gardens with a market value of $4,800 over a period of a year. The Produce Inventory System tracked a total of 5,287 pounds donated to the SAFB over a period of one year with a market value of $8,459.

2. Educate SNAP clients about the use of EBT/Lone Star cards at farmers' market

The goal of this portion was to educate SNAP clients about the use of EBT/Lone Star cards at Farmers' Market by outreaching a minimum of 12,400 individuals* and 529 community agencies. Outreach media avenues included flyers/handouts distributed at FMs and Health Fairs and SAFB's network of 535 agencies to make the information available to SNAPed clients or eligible individuals. Social media outreach took place through the SAFB website. Staff worked with vendors to keep FMs prices at supermarket level or below as incentive to use EBT cards at FMs. The SAFB provided extra free fruits or vegetables to clients using the EBT cards at FMs.

A total of 133,937 individuals and more than 535 agencies were reached throughout the 2012 year.

3. The SAFB – Spurs Community Garden doubled the production of Specialty Crops

The Annual Produce Inventory System yield for FY 2010-2011 was estimated to be about 10,000 pounds of produce and the goal was to produce at least 20,000 pounds of produce classified as specialty crops. The SAFB-Spurs Garden produced a total of 39,203 pounds through a year surpassing the goal.

The garden was reduced substantially during the fall (< ¼ acre) due to construction of the SAFB to expand storage capacity for frozen food. The garden is being moved to a newly acquired property of five acres and should be producing by summer of 2013.

Beneficiaries

Twelve gardens were built and moved into production benefiting approximately 2,114 individuals (704 families). Two of the organizations served only children through an afterschool program (Eastside Boys& Girls Club = 125 kids) and an orphanage (St. P.J. Orphanage = 40 children).

Lessons Learned

1. The commitment to the maintenance of the gardens built was not always there and it cannot be overemphasized and include the following areas:
   a) Understanding maintenance requirements which are weeding, timely automatic or manual irrigation, pest/insect control and timely harvesting of the produce
   b) Finding and organizing the volunteers or staff to provide the maintenance is a big challenge. If it is a true community garden the agreements between the community garden individuals needs to be well defined and enforced.
2. The combination of Healthy Cooking Curriculum with a Gardening Curriculum at schools proved to be an effective motivational and educational tool to establish gardens in schools generating interest from school officials, children and volunteer parents.

Additional Information

1) link to pictures documenting planting
   https://www.facebook.com/media/set/?set=a.468991866446127.112317.130229976988986&type=1#!/media/set/?set=a.468991866446127.112317.130229976988986&type=1

2) link to an article–September 2012
   http://www.mysanantonio.com/life/article/Geoffrey-Martin-finds-joy-in-helping-3865930.php#photo-3455363

3) MEDIA FOR THE GARDEN – MARCH 2012

   Public Beat is an organization that helps spread the word about events through their website and more. They were on Great Day SA and talked about the Gardening 101 class.
   http://www.kens5.com/great-day-sa/Who-let-the-dogs-out-143694236.html

4) Blog advertising gardening classes
   http://freeisfantastic.com/2011/08/22/square-foot-gardening-by-geoffrey-martin/

Comparison of actual accomplishments with the goals established

Goals	Grant Goals Established	Final Accomplishments
Assist organizations to establish gardens to grow Specialty Crops	10 Gardens	17 organizations requested assistance 12 Built 3 in progress 2 dropped out
Encouraged donation of surplus produce to the SAFB to be distributed to low-income families affected with food insecurity through the	3000 Pounds of produce Market Value: $4,800 ($1.60/pound)	5,287 Pounds of fresh produce donated to the SAFB and distributed through the network of agencies Market Value: $ 8,459 (Nov 30/12)

SAFB network agencies		
To educate SNAP clients about the use of EBT/Lone Star Cards at Farmers' Markets by outreaching low-income individuals and community based organizations	Outreach at least 12,000 SNAP eligible individuals Outreach at least 529 agencies	133,937 individuals were outreached with educational flyers, handouts and mass media messages More than 535 agencies were outreached with flyers and messages promoting the use of EBT cards at Farmers' Markets
To double the production of produce classified as specialty crops at the SAFB-Spurs Community Garden	Double the production of previous year and produce at least 20,000 pounds of produce classified as Specialty Crops	Produced 39,203 pounds of produce considered specialty crops over a year and quadrupled the previous year production.

The Gardening Network is planning a gardening workshop to take place on January of 2013 targeting the San Antonio Churches. The idea is to empower churches to build gardens and donate their harvests to improve the diet of individuals affected with food insecurity. The harvested produce will be donated to the SAFB or to the pantries associated with the churches. The speakers invited for the workshop will provide the attendees with practical information on how to build a garden, where to obtain resources and how to maintain a garden. The hope is to expand the capacity of the community to grow their own food and improve their diet.

PROJECT 21: PROMOTING SPECIALTY CROPS NOW AND IN THE FUTURE: RETAIL, FARMERS MARKETS PRODUCE PROMOTIONS AND CHEF EDUCATION

Partner Organization: Texas Department of Agriculture
Project Manager: Richard De Los Santos
Phone: (512) 463-7472
Email: Richard.DeLosSantos@TexasAgriculture.gov
Type of Report: Final
Date Submitted: December 2014

Project Summary

Produce continues to play a vital part of the Texas agricultural economy. The Texas Department of Agriculture (TDA) developed a creative marketing program designed to increase produce visibility and consumer awareness for Texas produce through enhanced produce demonstrations and culinary educational events, which showcased fresh produce available at Texas retail outlets, farmers markets and Texas restaurants. In addition, the purpose was to increase consumption and sales of Texas produce.

- TDA worked with the produce industry and retailers to create produce demonstrations and culinary educational events to showcase fresh produce available at Texas retail outlets, farmers markets and Texas restaurants. With success of in-state produce demonstrations TDA was able to expand demonstrations to out of state retail chains. As part of TDA's retail program, TDA conducted a series of retail in-store demonstrations that provided pecan nutrition information, product samples and preparation ideas to the consumer.

- TDA created and distributed informational literature on Texas produce and produce stickers to identify produce as Texas grown.

- TDA developed a webpage, Smart Phone App and Media Outreach program. TDA designed a new webpage and smart phone application to list sources of fresh produce for consumers. The smart phone app will also be shared with Project 22 Retail Plant Promotions and Retail Nursery Education.

- TDA created mobile training events to enhance the restaurant promotions and to bring chefs and growers together and inform them on each other's needs when it comes to growing and selling Texas specialty crops to restaurants.

Project Approach

The overall marketing campaign *Promoting Specialty Crops Now and In the Future – Retail, Farmers Markets Produce Promotions and Chef Education* was conducted in four phases.

Phase I

In order to create a successful promotion, TDA considered what needed to be accomplished. First, TDA had to reach new customers then TDA had to show current and new consumers

the versatility in usage of Texas produce and finally TDA had to build stronger relationships with our retail partners. The retail promotions began by showcasing Texas specialty crop marketing opportunities to retailers, restaurants and farmers markets. In order to accomplish this TDA attended the United Fresh Produce Show, Texas Watermelon Association and the Texas Produce Association convention to showcase TDA retail marketing opportunities. TDA also advertised in The Packer to increase industry awareness of the retail opportunities available through TDA. As a result, TDA was able to organize and conduct 419 produce demonstrations and culinary events to showcase fresh produce available in Texas. These produce demonstrations were conducted at eleven retail grocery stores in Texas as well as in six states outside of Texas. TDA also worked to boost the Texas pecan industry by working with Texas Pecan Board to conduct pecan retail demonstrations at retail grocery stores. The Texas Pecan Board provided pecan information to distribute at retail events. TDA did not need to print the 50,000 pecan educational brochures for distribution in retail outlets as originally anticipated. Produce demonstrations also occurred at 32 farmers markets between October 2011 and November 2012. During this same period TDA conducted 317 restaurant promotional events at local GO TEXAN restaurants. In addition during the 2014 farmer's market season TDA conducted an additional 12 farmers markets produce demonstrations. In order to insure that specialty crop funds were only used for qualifying products, TDA required markets to submit a list of what ingredients were to be used before their approving the markets project. In addition TDA also required markets to submit photos of their demonstrations/project after completion so that we can verify only qualified products were used. TDA showcased Texas produce and asked consumers to look for Texas produce at local retailers at multiple consumer events including the Taste of Dallas, State Fair of Texas and other consumer events. TDA partnered with the Texas Vegetable Association and the Texas Watermelon Association to purchase media spots to air TV commercials showcasing Texas produce. These TV commercials were aired at the same time as the retail demos in order to show a unified promotional marketing campaign. The cost for the air time was cost shared with the Southwest Dairy producers and project 22. Airtime purchase included TV time for the Texas Local Florist and the Texas Superstar marketing programs.

Phase II

TDA specialty crop marketing projects included the creation of key marketing materials for distribution at retail, farmers market and restaurant events. TDA partnered with Fresh Point to create local producer brochures for restaurants and chefs. These brochures educated local chefs on where to find Texas produce which were also distributed in conjunction with the GO TEXAN Restaurant Round Up. TDA also created posters and save the date cards and printed and distributed 25,000 to consumers. To help enhance the retail promotions TDA created produce bags for events and printed 500,000 produce stickers. These stickers were distributed to Texas producers to tag produce as Texas grown. Tagged produce was available at grocery stores during the GO TEXAN retail events. TDA also created farmers market banners to direct consumers to markets offering Texas produce.

Phase III

TDA worked to design and revamp the GO TEXAN website to include a larger focus on Texas produce. It is now easy for consumers to find information on cooking with Texas produce and provides an array of many different recipes for consumers. Consumers and

wholesale buyers can also easily find Texas produce and growers on the GO TEXAN website. TDA also created the Texas produce section on the GO TEXAN app. This app allowed consumers to find Texas produce at local farmers markets, pick your own farms and local restaurants. In addition, TDA aired TV and online commercials directing consumers to the new GO TEXAN page. TDA tracked click-throughs on TDA's web site.

Phase IV
TDA partnered with Texas A&M AgriLife Extension and the Lubbock chapter of the Texas Restaurant Association and the El Paso Farmers Market to conduct 3 mobile training events in the San Antonio, Lubbock and El Paso areas. These events were designed to bring chefs and Texas producers together to discuss how growers packaged their produce and how restaurants would like to see it packaged. Topics covered included products needed by restaurant, food safety, availability and seasonal growing seasons. The information helped growers tailor their crops to meet the needs of the restaurants and it helped the restaurants understand the limitations of the local producers. TDA was not able to conduct 2 of the mobile training events due to weather effects on crops and the difficulty of scheduling time of the producers to fit the time available of the chefs.

Goals and Outcomes Achieved
Goal 1: TDA's goal was to increase consumer awareness of fresh Texas grown produce available to consumers by conducting retail demonstration and culinary events. TDA also worked to increase the awareness of these specialty crops by pairing chefs with local farmers markets during demonstrations. This effort has proven to be very successful and produced great results both from the retail and consumer levels. The twenty-nine supermarkets in six states were involved in the December holiday promotion reaching several thousand consumers. In addition the consumer retail events in Texas, Market to Menu promotions and the consumer culinary events reached an additional 20,000 consumers.
Target 1: TDA expected to see a 200% increase in sales of fresh Texas produce at retail sites and Market to Menu events. Results were based on an average of sales for the entire duration of the project. The out of state retail demonstrations resulted in an increase in movement of 237.8 % according to the reports submitted by the Edinburg Citrus Association and Remke Grocery stores. According to retail reports the retail demonstrations resulted in an average of 678% increase in sales of Texas produce. The products that were showcased at the retail events included pecans, spinach, squash, onions, mushrooms, peaches, watermelons, onions, corn, grapefruit, eggplant, blueberries, herbs, oranges and many more. During the Market to Menu events, participating markets reported 1,695 samples were distributed, the increased advertisements and promotions resulted in 7,469 attendees which is up 18% from the previous year at the same time. Most importantly the markets reported total produce sales of $76,796.50 which is an increase of 23.20%

The average increase in sales of all the events was 313% which is well above the expected 200% increase.

Goal 2: TDA's goal was to design a new webpage and smart phone application that will list sources of fresh produce for consumers.

Target 2: TDA set a target to see 2,000 hits the first year the newly designed web page and app are launched. TDA tracked hits and visitors to the updated Web page and new smart phone app listing farmers markets and farms that sell fresh produce. TDA utilized Google Analytical programs to track the hits and visitors to the site. TDA was also able to track the number of consumers that downloaded the apps. In September 2012 the iTunes Connect reports showed the iPhone app had been downloaded 1,427 times. As of February 2014 reports indicate that 12,200 consumers have downloaded the iphone app. In September 2012 Google Play reported 640 downloads of the Android app. As of February 2014 reports indicate that 1,593 consumers have downloaded the Android app. Google analytics shows that in 2012 there were 124,899 visits to GO TEXAN.org and this rose to 135,331 in 2013.

Goal 3: As part of the culinary education, TDA developed mobile training events to bring chefs and growers together and inform them on each other's needs when it comes to growing and selling Texas Specialty Crops to restaurants.
Target 3: TDA expected to have more than 25 growers and 100 chefs participate in the mobile workshops. The mobile training events were difficult to coordinate due to weather issues and coordinating schedules of growers and chefs. TDA was only able to conduct 3 of the 5 training events. Only 12 producers and 25 chefs participated in the events. Tracking the sales was also difficult. Texas producers did not report any increase in sales as a result of events.

Beneficiaries
The events, projects and campaigns assisted fruit and vegetable growers in Texas by showcasing their products, increasing the value of the crops they produce and enhancing their competitiveness in the marketplace. More than 400 growers and over 100 restaurants benefited from increased sales and product awareness campaign while more than 20,000 consumers experienced Texas produce prior to purchasing. The series of retail in-store demonstrations conducted also provided the consumer with nutrition information, product samples and how-to information for an array of Texas specialty crops.

Lessons Learned
TDA learned that we need to allow more time for market to menu. Weather and crop issues delayed some of the events which resulted in extension of the deadlines. TDA improved how funding is distributed to retailers by creating a more competitive application program. TDA also created a better application and reporting process for market to menu to insure that only Texas specialty crops were included in all the events. As stated above, in order to insure that specialty crop funds were only used for qualifying products, TDA required markets to submit a list of what ingredients were to be used before their approving the markets project. In addition TDA also required markets to submit photos of their demonstrations/project after completion so that we can verify only qualified products were used. Getting chefs and growers on the same schedule is extremely difficult and TDA will be working on developing new opportunities for both.

Additional Information

GO TEXAN APP

GO TEXAN Webpage features Texas produce recipes (cost shared with GO TEXAN food program)

http://www.gotexan.org/ExperienceGOTEXAN/Recipes.aspx

Farmers Market Banner

Market to Menu

Photo of bags created to use at Market to Menu events and retail promotions.

Texas Pecans and Spinach (Cost shared with Shrimp Program)

Texas Watermelon and Arugula Promotion (Cost Shared with Shrimp Program) – Promoting Texas Produce in restaurants

NH\Hb3905;05345b3917:18;1zpy

Retail Demonstrations
Fiesta

Execution Excellence
TPM
Demo Photos: TX Sweet Onions
GO TEXAN.
Fiesta Mart Photos – May 2012

Execution Excellence
TPM
Demo Photos: TX Sweet Onions
GO TEXAN.
Fiesta Mart Photos – May 2012

Execution Excellence
TPM
Demo Photos: TX Sweet Onions
GO TEXAN.
Spices
Fiesta Mart Photos – May 2012

Whole Foods

LOCAL

SALE

Remke advertisement for oranges & grapefruit

Wal-Mart Pecan demos

Kroger

GO TEXAN stickers on Texas produce during retail promotions

TV Commercials airing during retail campaign (cost shared with Southwest Dairy Producers)

http://youtu.be/6isI5xi5odI?list=UUPTL2D7kB-HqlU7ojeE_Phg

http://youtu.be/u5sRJij5BT4?list=UUPTL2D7kB-HqlU7ojeE_Phg

Christmas Tree Brochure

Restaurant Round Up (cost shared with GO TEXAN Food program) Poster

Web ad

Fresh Point Grower brochure for restaurants – brochure featured 27 Texas produce companies

Mobile Chef Training

PROJECT 22: PROMOTING SPECIALTY CROPS NOW AND IN THE FUTURE: RETAIL PLANT PROMOTIONS AND RETAIL NURSERY EDUCATION

Partner Organization: Texas Department of Agriculture
Project Manager: Richard De Los Santos, (512) 463-7472
Project Type: Final
Date Submitted: February 2014

Project Summary
Horticulture crops continue to play a vital part of the Texas agricultural economy. These crops represent the largest specialty crop sector in Texas. The purpose of this project was to develop creative marketing programs that increase consumer visibility and awareness of horticulture products in order to increase customer purchases and industry sales. This project was a continuation of previous SCBGP projects implemented by the Texas Department of Agriculture (TDA) to add value to the Texas horticulture industry.

Goal 1:Design a webpage and smartphone app that will list retail Texas nurseries and local florists.
Goal 2:Increase the number of retail nurseries participating in marketing promotions and increase sales of Texas Superstar® plants by five percent.
Goal 3:Increase attendance at the Texas Nursery Landscape Association (TNLA) Expo Education Conference and Management Workshop and increase traffic to landscapetexas.org.

Project Approach
TDA developed a three phase program to expand Texas specialty crop visibility at the consumer level and to increase consumption and sales of Texas produce and horticulture plants through producer-driven and TDA-executed projects.

Create webpage and smartphone app
TDA originally proposed funding to create a webpage and smartphone app that would provide retail listings of nurseries and local florists; however TDA utilized funding from another source to develop the GO TEXAN app and website. Although Specialty Crop funds were not directly used to create the webpage and the app, TDA staff paid directly with Specialty Crop funds worked with florist, nursery retailers, and producers to gather the information that would be listed on the GO TEXAN webpage and the GO TEXAN smartphone app. Over the course of the project period, more than 1,000 hours were spent gathering and verifying information for the app. Using iTunes Connect and Google Play TDA is able to run reports that show the number of downloads of the mobile app.

Retail Plant Promotions
TDA also created literature to distribute at retail events as well as post on the GO TEXAN website. TDA created and printed 45,000 Earth Kind Rose brochures and worked with Texas A&M AgriLife Extension to distribute the information to consumers, master gardeners, retail nurseries and other locations.

TDA worked with Texas A&M AgriLife Extension to produce 95,000 Texas Superstar® plant stakes and hang tags, which were distributed by February 2012 to producers and retail nurseries.

Retail plant nurseries continue to display signs from previous promotions; therefore TDA did not develop the additional 500 signs as stated in the proposal. TDA did not add the QR codes to new tags because Texas A&M AgriLife Extension is currently working on updating the information and was not ready in time for production. Texas A&M AgriLife Extension received a specialty crop block grant under the 2012 cycle to develop the QR codes for Texas Superstars®. The portion of that project is still underway.

TDA was able to build on existing 2010 television campaigns and extend the use of commercials already developed in conjunction with the Texas Superstar® campaign and Texas Local Florist promotions. Where possible, TDA was able to include media outreach for the promotion of the GO TEXAN app. TDA also purchased additional media air time in the Austin, Dallas, Houston and San Antonio area and re-launched existing Texas Superstar® and Texas Local Florists commercials. The Texas Superstar® television commercial aired Mar. 12 – Apr. 7, 2012 and the Texas Local Florist television commercials aired Feb. 1 – Feb. 13, 2012 and May 1 – May 12, 2012.

Texas Nursery and Landscape Association Education Program

TDA worked with the Texas Nursery and Landscape Association (TNLA) to enhance retail nursery employee knowledge by developing an educational seminar at the Expo Education Conference, the Nursery/Landscape Expo and the TNLA Management Workshop Conference.

To achieve this, TNLA selected business speaker(s) for the TNLA Expo Education Conference and TNLA Management Workshop that fit the needs of the conference. The keynote education by Dr. Charlie Hall and Clint Swindall was attended by 302 individuals, giving attendees a unique insight into the green industry economy and generational factors influencing their businesses.

Transfer of TNLA Certification Exams to new host

TNLA offers a certification program to Texas nurseries and landscapers to let consumers know they are doing business with true professionals that hold a high degree of knowledge and skill level in the nursery and landscape industry. They have made becoming a Texas Certified Professional easy with online access to both study materials and testing. SCBG help TNLA contact with a third party development company, Stella International, to build the new exams from scratch and host them on Stella's servers. This service also allowed for TNLA connect the exams on the back end their database so that nurseries and landscapers could register and pay to access the exams. (http://txnla.org/certification/certification_main)

Website Promotion

TDA and TNLA began marketing the consumer website landscapetexas.org, a tool to identify retail nurseries and landscapers using Texas plants. TNLA worked with designers to develop

a promotional piece marketing the new consumer website. TNLA staff met with TDA to discuss marketing strategies, options, and graphics. TDA marketed the website through various media outlets, including the GO TEXAN Facebook page and website, gotexan.org.

By increasing the traffic of consumers to the landscapetexas.org site, consumers are shown the possibilities and excitement of embracing the green industry. With videos of do-it-yourself projects, getting children involved in specialty crops and fun ways to incorporate these projects into your life, consumers are given useful and practical ideas that encourage them to participate in the specialty crop industry. In an industry that has very cyclical sales, it is important that we provide consumers with ideas and the empowerment that they need to begin a project that will support specialty crop sales.

Goals and Outcomes Achieved

Goal 1 was to design a webpage and smart phone application that will list retail nurseries and local florists. The target was to see 2,000 hits the first year the newly designed webpage and app were launched.

As of September 2012, the iTunes Connect reports showed the iPhone app had been downloaded 1,427 times. As of February 2014 reports indicate that 12,200 consumers have downloaded the iPhone app. In September 2012, Google Play reported 640 downloads of the Android app. As of February 2014 reports indicate that 1,593 consumers have downloaded the Android app.

Goal 2 was to see a 10 percent increase in the number of retail nurseries and florists participating in the promotions. In addition, TDA expected a 5 percent increase in sales of Texas Superstar® plants as a result of the promotions.

The Texas State Florist Association reported an average increase in sales in the Dallas, Houston and Austin areas of 17.15 percent as a result of the campaign. Surveys of retail nurseries did not indicate any increase in sales as a result of the promotions.

Furthermore, the Retail Plant Promotion section of this project has contributed to the following success:

- The Texas Local Florist analytic report for Feb. 6 – Feb. 15, 2012 shows 87.81 percent of traffic was new website visitors while the Mar. 7 – Mar. 12, 2012 analytics report shows 91.16 percent of visitors were new.
- The Texas Superstar® campaign resulted in 2,317,564 impressions.

Previous year's results showed a 5 percent increase in sales of Texas Superstars®.

Goal 3 was to increase attendance at the Expo Education Conference and Management Workshop, as well as increase traffic to the landscapetexas.org site. TNLA expected to increase the attendance by 5 percent over the previous year's attendance and increase traffic to the landscapetexas.org website by a minimum of 5 percent from the current traffic.

TNLA reported 302 attendees participated in the Expo Education Conference. Survey results indicated attendees were extremely satisfied with the materials presented and the information they were able to learn during the Expo Education Conference. TNLA was not able to achieve the 5 percent increase in attendance for the Expo Conference and Management Workshop as anticipated. During the Expo Education Conference, Houston was hit by severe weather for two days. This affected the attendance of both the Expo and the Expo Education.

As a result of marketing and promotions of the landscapetexas.org website, TNLA reported that in July 2012, after promotions launched, reports indicate there were 78 visits; 71 unique visitors (87 percent new visits) to the landscapetexas.org website. In July 2013, one year after the promotion launch and continued promotion, TNLA reported 248 visits; 231 unique visitors (91.53 percent new visits).

Beneficiaries

The completed projects and campaigns benefited nursery/landscape growers in Texas by showcasing their products, increasing the value of the crops they produce and enhancing their competitiveness in the marketplace. More than 100 growers and 500 retail nurseries benefited from increased sales and product awareness.

The TNLA Management Workshop Conference, the Expo Education Conference, and the Nursery/Landscape Expo were open to every segment of the green industry, which impacted 7,000 attendees and allowed them to gather new information on trends and tools to make their businesses a success. Additionally, 302 growers benefited from the Expo Education Conference.

Lessons Learned

TDA will continue to work with the horticulture industry to promote Texas plants and flowers. The biggest obstacle was related to gathering results. Nursery/Landscape Producers, retail nurseries and florists were all eager to participate in the promotions; however, when it came time to gather the data, it took longer than anticipated to assemble. TDA needs to find a better way to collect the information from the participants.

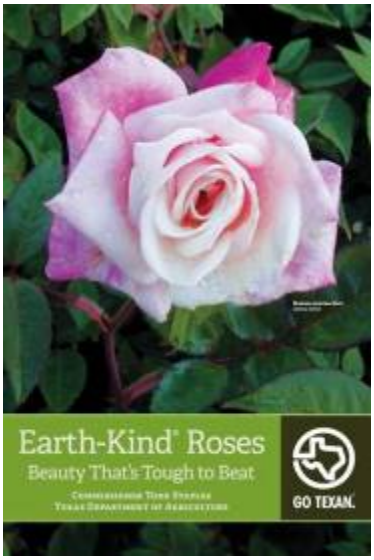
Additional Information

GO TEXAN app

Texas Superstars® Strong Every Season TV Commercial (Show Texas Superstar® Plant stakes)http://youtu.be/nI9-ZC_-KUI

Texas Local Florist (Show Local Florist Hang Tags)
http://youtu.be/dXB897UTL4g

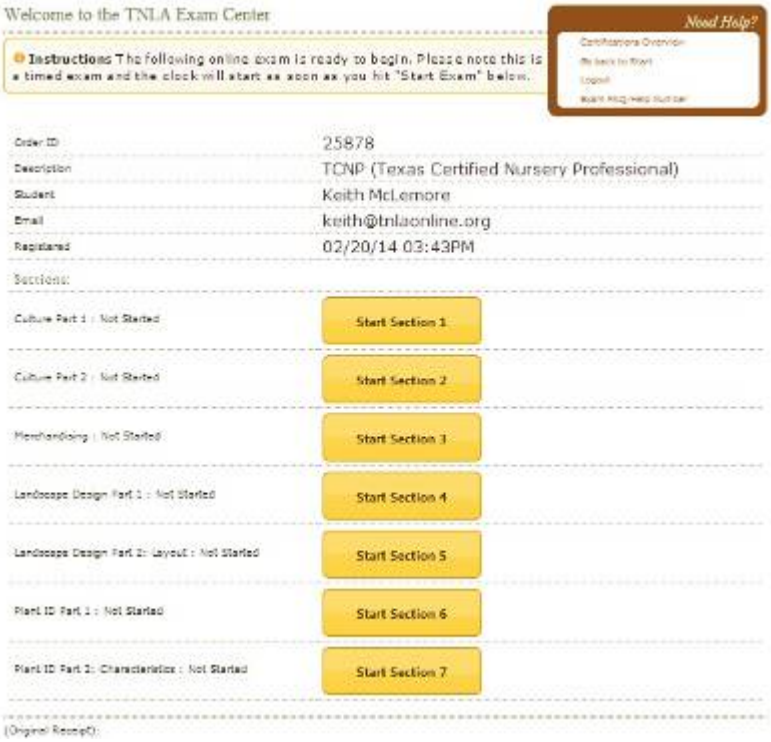
Earth Kind Rose Brochure



TNLA Expo Education Conference

TNLA Expo

TNLA Certification Exam Portal


Welcome to the TNLA Exam Center
Need Help?
Instructions The following online exam is ready to begin. Please note this is a timed exam and the clock will start as soon as you hit "Start Exam" below.
Order ID
25878
Description
TCNP (Texas Certified Nursery Professional)
Student
Keith McLemore
Email
keith@tnlaonline.org
Registered
02/20/14 03:43PM
Sections:
Culture Part 1 : Not Started
Start Section 1
Culture Part 2 : Not Started
Start Section 2
Merchandising : Not Started
Start Section 3
Landscape Design Part 1 : Not Started
Start Section 4
Landscape Design Part 2: Layout : Not Started
Start Section 5
Plant ID Part 1 : Not Started
Start Section 6
Plant ID Part 2: Characteristics : Not Started
Start Section 7
(Original Receipt):

TNLAOnline services portal
Your full service information resource
Exam in progress.
Need Help?
Culture Part 1
Instructions: Select the correct answer from the options for each question:
5) The picture can be identified as:
Nutgrass
Redstem Filaree
Sowthistle
Johnsongrass
Save & Continue
Culture Part 1 (0.50hrs): In Progress

PROJECT 23: PROMOTING SPECIALTY CROPS NOW AND IN THE FUTURE: GRAPE GROWING WORKSHOP

Partner Organization: Texas Wine and Grape Growers Association
Project Manager: Debbie Reynolds (817) 421-3201
Email: debbie@twgga.org
Type of Report: Final
Date Submitted: January 2013

Project Summary
In order to grow and sustain the production of Texas grapes, education is a key component. Seasoned as well as new growers are continually focused on expanding their knowledge of grape growing to create a more robust industry and crop. This project will give the Texas grape growers the ability to build a favorable, more substantial industry for the future.

The Grape Growing Workshops were held at the Texas Wine and Grape Growers Association Annual Conference and Trade Show. This was the perfect venue to disseminate the most current information to a wide and varied audience.

The workshops were divided into three tracts: Growing, Marketing, and Compliance. The breakdown of topics included:
Growing
- Rootstock Evaluation
- Debunking Popular Grape Growing Misconceptions
- Top Vineyard Management Problems and How to Overcome Them

Marketing
- Top 10 Secrets to Selling Grapes and Wine
- Strategic Positioning and Marketing

Compliance:
- Presentations from representatives with the Texas State Comptroller and Texas Alcohol and Beverage Commission
- Overview legislative issues

In each of the workshops, industry experts and viticulture/enology educators presented information providing much needed knowledge to move the Texas grape crop forward and grow the economic impact to the State of Texas.

Project Approach
The project involved a series of activities/tasks whose successful completion were integral to the overall project's success.

1. Research, select, and secure meeting space: The Association had previously established a relationship with the Embassy Suites San Marcos Hotel, Conference Center. After researching similar properties in the area and it was determined the Embassy Suites San

Marcos was the best fit for the size, layout and financially. Securing meeting space is crucial to any successful meeting.

2. Secure Speakers: The Association's Education Committee is comprised of winery owners/winemakers, grape growers, industry advisors, and educators. This committee's role is to build a meeting program that covers all facets of the industry and interest of the attendees. Their role was the focal point of the grant…building the workshops with topics and speakers who will generate interest and provide pertinent information. The Committee began their selection tasks approximately nine months in advance. Suggested topics from previous conference surveys were taken into consideration. Vital in this task is the securing of speakers and topics far enough in advance to promote registration, which must be available no less than 90 days before the workshop.

3. Research and develop information for distribution: The Association website is the primary source of information for meetings and events. An economical way of maintaining the website is to keep all tasks in house.

For the conference, all information was posted on the website and included speaker pictures and bios, program agenda with topic description, registration, and post-workshop survey. The association created newsletters and announcements that were easily distributed to all email lists. The timely release of information created interest and increased registration for the workshops.

4. Research and develop educational materials: A a speaker handbook outlining requirements for PowerPoint presentations, A/V needs, handout specifications and due dates were created and provided to each speaker with a PowerPoint template for uniformity and ease of viewing. Past experience taught the association workshop attendees prefer written materials in hand during the workshop presentation. By receiving PowerPoint in advance handouts were created and given to attendees at registration. Thirty days after the conclusion of the workshop, the speaker presentations and handouts were posted on the Association website. Workshop attendees and website visitors can download these files. Presentations were also videoed and posted to the associations website.

5. Survey workshop attendees: The Association uses Constant Contact to distribute the post-workshop survey. The survey was released on February 27, 2012, approximately ten days after the close of the conference. The survey was open for six weeks. There were 120 responses, a 26 percent response rate.

Goals and Outcomes Achieved

The primary goal was to develop a grape growing workshop to increase the knowledge of grape growers on the production of grape varietals as well as how to overcome major production issues. The association created multiple workshops conducted within a three-day period and created a learning library with printed materials and videos. The expected attendance and knowledge gained exceed target of 300 attendees and 75 percent gain in knowledge. Actual attendance was 455 and survey results indicated an average 11.35 percent increase in knowledge. The outcomes of the workshops will be measured over the long term

as to the number of new vineyards established and new varietals planted. In 2006, there were approximately 3,200 acres of vineyards in Texas. Today, that number has grown to close to 5,000.The outcomes of the workshops will be measured over the long term as to the number of new vineyards established and new varietals planted. In 2006, there were approximately 3,200 acres of vineyards in Texas. Today, that number has grown to close to 5,000.

Beneficiaries

The primary beneficiaries of this project were the wine makers and grape growers. The more knowledgeable the grape growers, the more grapes are grown. The more grapes are grown, the more wine produced. There were 230 bonded Texas wineries at the beginning of this project. Today, there are 259 bonded wineries. The secondary beneficiaries are the consumers and the State of Texas. More growth, sales, taxes, and increased tourism will have a more favorable impact to the economy of the State of Texas. In 2007, the Texas Wine Industry's economic impact to the State of Texas was $1.35B. That number grew to $1.7B at the end of 2009. The study results for 2011 will be released toward the end of 2012. Staff expect to see the economic impact grow to close to $2B.

Lessons Learned

The event staff held a meeting debrief the week after conference to discuss the logistics and determine where improvements could be made.

A pre-conference survey is required to determine knowledge level and areas of focus for workshop topics. A possible venue to conduct this survey is at Grape Camp held the first weekend in November. It is attended by grape growers both new and seasoned.

The amount of time spent with vendors/exhibitors and educators will be increased from 8 hours to 14 hours during the next three-day conference. A small stage area will be added to allow vendors to conduct education workshops.

Additional Information

CBS National News script, July 30, 2012.
To view the video, visit http://www.cbsnews.com/8301-201_162-57483091/amid-drought-wine-grapes-save-a-cotton-farmer/?tag=cbsnewsSectionContent.1.

PROJECT 25: INCREASING SALES AND BRAND AWARENESS THROUGH MARKETING THE NUTRITION ASPECTS OF TEXAS GROWN WATERMELON

Partner Organization: Texas Watermelon Association
Project Manager: Ward Thomas
Email: ward@majesticproduce.com
Type of Report: Final
Date Submitted: December 2014

Project Summary

Texas watermelon production represents $86,991,172 of the Texas Agriculture industry. The Watermelon industry has extensive data from researchers touting the many nutritional benefits of watermelon. This project provides an opportunity to use the data to educate consumers and increase sales of Texas Watermelon. The purpose of the campaign was to build on current successes in sales, brand awareness and health education of Texas Watermelons. The media campaign ran in both the Austin and San Antonio markets from May 19 – July 4, when it is hot outside and people are most likely to purchase watermelons. There are two major holidays during this timeframe, the Fourth of July and Labor Day. This project will help promote Texas Watermelons during peak season to aid in the growth of sales.

Project Approach

TWA utilized the following marketing tactics to reach our target demographic – Women (Mothers), ages 25-54:

> *Television Commercials*: TWA used a contractor to plan, negotiate and buy spot television schedules in Houston and Dallas. We ran 60 10-, 15- and 30-second commercials on a major network station in Houston and 54 10- and 30-second commercials on another major network in Dallas. To save on production costs, we used the existing "Watermelon Smiles" commercials. All television commercials ended with an action item asking the consumer to "Look for the GO TEXAN mark when purchasing your next watermelon."
>
> *Online advertisements*: We ran standard display ads (sized 300x250 and 728x90) on a custom channel of websites with a high ComScore ranking with our target audience, geo-targeted to Dallas and Houston. This resulted in 805,904 targeted impressions. Additionally, we engaged in behavioral targeting within the custom channel, which resulted in 460,169 impressions to online users exhibiting behaviors similar to our target audience. Finally, we ran 15-second pre-roll video within a vertical channel of sites focused on women's lifestyle, parenting and local media to gain another 593,291 impressions. Our online efforts resulted in a total of 1,859,364 impressions and 2,349 clicks. To save on production cost, we used existing online banner advertisements and utilized our "Watermelon Smiles" 15-second spot for video pre-roll online. Online ads asked the consumer to "Look for the GO TEXAN mark when purchasing your next watermelon."

In-Store Demonstrations: Staff collaborated with HEB to perform in-store demonstrations and taste tests at 323 locations during the campaign.

Goals and Outcomes

The qualitative goal of this campaign was to increase consumer awareness of the quality of taste and nutrition of Texas watermelons. We encouraged consumers to visit restaurants that purchase/serve local produce/watermelons; and we promoted the health benefits of eating fresh Texas watermelon at home, work or at a restaurant. Based on the number of impressions and reach achieved by the media plan, TWA is confident that awareness increased among our target audience. The quantitative goal was to see a 200% increase in sales of Texas watermelons as a result of the new marketing campaign. Reports show that watermelon sales increased 322% from the period prior to the campaign. Typically, sales of watermelon during in-store demonstrations increased an average of 120%, and we saw a 171% lift. The TWA and TDA worked with Texas watermelon producers and retailers to monitor sales during and after promotions. The information gathered was compared to sales from the previous week before the event occurs to determine a percent increase in sales. Additional Information: Texas Watermelon Association was also featured in a spread for Texas Produce Magazine. We promoted our shippers as well as the message that reflected our "Watermelon Smiles" creative.

Beneficiaries

The marketing campaign benefited Texas 27 handlers and 114 producers including Bagley Produce, Farmers Marketing Service, Hinojosa & Sons, M & P Produce, Majestic Produce, McWhirter Farms, Nat Coleman Produce, Nowell Borders Co., Palmer Farm & Ranch Inc., Ronnie Borders Co., Sandia Depot, Texas Melon Exchange, Wade Pennington & Sons Co., Warren Produce, Watermelons Unlimited and Wiggins Watermelons.

Lessons Learned

Scheduling in-store demonstrations proved to be a much slower process than anticipated. In the future, scheduling in-store demonstrations with grocers such as HEB, Whole Foods, Central Market, etc. should begin as soon as possible – ideally several months in advance.

Additional Information

Texas Watermelon Association was also featured in a spread for Texas Produce Magazine. We promoted our shippers as well as the message that reflected our "Watermelon Smiles" creative.

PROJECT 26: TEXAS ORGANIC INITIATIVE

Partner Organization: National Center for Appropriate Technology
Project Manager: Michael Morris
Contact Information: mikem@ncat.org or 210-265-3905
Type of Report: Final
Date Submitted: 10/29/14

Project Summary

By a conservative estimate, sales of organic produce within the state of Texas are approximately $250 million per year, and only a very small percentage of this produce is Texas grown. Texas ranks 20th in the nation in the number (279) of certified organic operations. A 2007 Texas Department of Agriculture (TDA) study commented, "The number of certified organic operations in Texas has remained relatively stagnant while nationally the organic food sector has experienced double-digit growth." (York et al, 2007) Texas specialty crop growers are clearly missing out on some good opportunities in the organic sector.

A study by Constance and Choi (2010) found that 80 percent of Texas producers "were not sure about" or "did not understand" organic certification. About 80 percent also reported "a lack of both informational and services support regarding organic production methods." Despite this widespread lack of basic information and support, over 40 percent of conventional (non-organic) Texas operators were open to the idea of organic farming and had at least some interest in it. (Constance and Choi, 2010)

The National Center for Appropriate Technology (NCAT) conducted a targeted educational campaign, addressing the questions that Texas specialty crop growers are asking about organic farming. Project staff provided user-friendly information about the organic certification process; crop-specific information about soil fertility, pest control, and weed control; and objective information about the economic realities and risks of organic production. Opportunities were created for conventional specialty crop producers to learn from peers who are using organic methods. Project staff worked with produce buyers, seeking ways to increase wholesale and retail markets for organic specialty crops. They created and distributed a directory of organic product buyers to specialty crop producers. In addition, produce growers were connected to the full range of free technical assistance available to them through NCAT's ATTRA Project and its office in San Antonio.

The objectives of this project were to:

- Inform and educate Texas specialty crop producers about organic requirements, certification, marketing, processing facilities, enterprise budgets, and production methods.
- Strengthen ties between buyers (both wholesale and retail) and Texas growers of certified organic specialty crops.
- Create linkages between the leading Texas organic trade organization—the Texas Organic Farmers & Gardeners' Association (TOFGA)—and specialty crop trade organizations.

- Increase usage by Texas specialty crop growers of the free resources and technical assistance services available through NCAT's ATTRA Project and San Antonio-based office.

Project Approach

NCAT offered exhibits and booths and gave presentations at five grower meetings:
(1) The Texas Organic Farmers & Gardeners' Association (TOFGA) conference in Houston. Our talk was attended by 30 specialty crop growers, and about 50 more visited our booth.
(2) The Fort Bend Vegetable Growers Conference in Fort Bend. We spoke briefly to all 150 specialty crop growers in attendance, and many of these visited our booth.
(3) The Texas Certified Farmers Markets Association meeting in Seguin. Along with an experienced organic grower, we spoke briefly to all 125 specialty crop growers in attendance, and many of these visited our booth;
(4) The Texas Fruit Growers conference in Fredericksburg. We spoke briefly to all 75 specialty crop growers in attendance, and many visited our booth;
(5) The Texas Pecan Growers conference in San Marcos. We were joined by an experienced organic grower, and about 200 of the 600 attendees visited our booth.

At these meetings more than 500 publications were distributed on organic farming, certification, and marketing.

NCAT organized and hosted a meeting in August 2014 between 16 specialty crop growers and produce buyers from H-E-B, the largest grocery chain in Texas. The meeting took place at H-E-B's large retail produce distribution center in San Antonio. Participants discussed ways to facilitate sales of organic produce by Texas growers to H-E-B.

In May 2014 NCAT launched a newsletter, *The Texas Organic Chronicles*, and sent out eight issues to a mailing list of more than 1,500 people, including an estimated 500 specialty crop growers. The newsletter provided regular educational features and news related to organic certification and production.

NCAT worked closely with Dr. Juan Anciso of Texas A&M AgriLife Extension to organize a Good Agricultural Practices Food Safety workshop in Seguin in August 2014, attended by 25 people.

NCAT offered two webinars on organic certification, aimed specifically at specialty crop growers. The first webinar covered the basics of certification and featured Leslie McKinnon (formerly with the organic certification program at the Texas Department of Agriculture) and well-known organic farmer Brent Johnson. The second webinar covered organic system plans, and featured Mary Ellen Holliman, COORDINATOR FOR ORGANIC CERTIFICATION Texas Department of Agriculture) and well-known organic farmer Skip Connett. 125 people attended these webinars "live" and 591 (so far) have watched the recorded versions, for a total of 716.

NCAT conducted evaluations for all workshops and webinars. Of 43 who evaluated the first webinar, 10 rated it "excellent," 29 "good," 2 "fair," and 2 "poor." Of 21 who evaluated the second webinar, Of 21 who evaluated the second webinar, 5 rated it "excellent," 14 "good," and 2 "fair."

With assistance from TOFGA, NCAT created a directory of organic produce buyers (*Organic Specialty Crop Production in Texas: a Grower's Handbook*) and distributed 300 copies.

There was a very substantial increase in the use of free technical assistance available to growers through NCAT's ATTRA Project and its office in San Antonio. To measure this increase we compared website visits in July-August 2014 to the number of visits in July-August 2013. Visits to the web page of NCAT's Southwest Regional Office (in San Antonio) more than tripled, from 92 to 319. Comparing this two-month period in 2013 and 2014, visits to the ATTRA website increased about 7 percent (from 80,337 to 85,880).

NCAT took great care to ensure that project funds were used solely to enhance the competitiveness of specialty crops. We carefully controlled the content of educational materials and presentations, ensuring that all of these dealt exclusively with specialty crops.

NCAT used funds from two other projects to leverage Specialty Crop Block Grant funds and enhance many educational activities. These other sources of funding were NCAT's ATTRA Program and the Subtropical Organic Agriculture Research (SOAR) project that is funded through USDA's National Institute of Food & Agriculture.

Goals and Outcomes Achieved

The project significantly strengthened ties between buyers and Texas growers of certified organic specialty crops. At least three new business opportunities were created as a direct result of the meeting that we arranged between 16 growers and organic produce buyers from H-E-B grocery. In other words, three businesses have either begun selling specialty crops to H-E-B or are taking active steps to do so. Anecdotally, we have heard of at least three other farms that participated in our project and are now strongly considering selling to H-E-B. (Because these business arrangements tend to be confidential, we have no way to know about all of the opportunities that may have resulted.)

At least four operations that participated in our project became certified organic. All started the organic certification process during our grant period and received their organic certification within a few months after the end of our project. These were Yahweh Farm (Harlingen, Texas), Terra Preta Farm (Edinburg, Texas), Nickerson Farm (Bryan, Texas), and the University of Texas-Pan American (for an organic research farm on campus).

We reached and educated a large number of specialty crop growers about organic certification. We believe that we exceeded our goal of substantially raising understanding of organic certification by at least 300 specialty crop producers. The various educational strategies in our project directly impacted 1717 specialty crop growers. If just 25 percent of

these substantially increased their understanding of organic certification, that would be 429 specialty crop grower. We think this is an extremely conservative estimate.

Project staff made two attempts to determine baselines and impacts more accurately:

- A total of 716 people viewed either the "live" or recorded versions of our two webinars. Of the 64 webinar attendees who completed the evaluation of the live webinar, 29 (45%) said that their understanding increased "a lot" or "substantially". Just 13 respondents (20%) self-identified as growers. We suspect that this under-counts the actual number of growers significantly. But if we assume that 20% of the 716 people who watched our webinars were specialty crop growers, and 45% of these substantially increased their understanding, then at least 64 specialty crop growers substantially increased their understanding of organic certification by viewing our webinars.

- In May and June (near the beginning of the project) we invited readers of our new *Texas Organic Chronicles* to fill out an anonymous electronic questionnaire, rating their understanding of organic certification. 95 people completed the questionnaire, and around half (48%) said they knew "just a little" or "almost nothing" about the process and cost of organic certification. Three quarters (73%) said they knew "just a little" or "almost nothing" about TDA's organic certification program. After sending out our *Texas Organic Chronicles* newsletter every two weeks from May through August, as well as offering webinars and other project activities, we offered a second questionnaire in August. Unfortunately only 4 people completed this questionnaire, so we were not able to directly measure changes in understanding by the estimated 500 newsletter recipients who were specialty crop growers. However, if we make the assumption that learning from the newsletter was at similar to learning from our webinars, then at least 225 specialty crop growers (45%) increased their understanding substantially by reading our newsletter.

Beneficiaries

The direct beneficiaries of the project were over 1,700 specialty crop growers who were directly impacted by this project and received the information and resources enabling them to seriously consider organic production. In time, Texas consumers will benefit through more choices of highly nutritious food. Grocers, and many related Texas retailers and food businesses will benefit by meeting the widespread and growing demand for organic food. Organic farming also has highly positive impacts on soil health, water quality, and wildlife. The economic impacts of this project will be substantial, considering the fact that Texas consumers currently buy around $250 million in organic produce each year. If the project causes even a one percent increase in Texas purchases of Texas-grown organic specialty crops, this will mean that $2.5 million consumer dollars stay in Texas instead of going to other states. These dollars will circulate through rural communities, multiplying these benefits many times over.

Lessons Learned

Interest in organic farming on the part of Texas specialty crop growers appears to be high. Almost all of the people who took our anonymous and voluntary electronic questionnaire agreed with the basic philosophy of organic farming (99%) and thought that organic farming is safer for consumers (93%), the environment (96%), and farm workers (98%). Interest in organic production was extremely high, with 87% reporting that they seek out information about organic production "often" or "very often," and 79% saying that they knew "a moderate amount" or "a lot" about farming successfully without the use of synthetic chemicals and fertilizers. A solid majority (75%) said they were "interested in organic farming but not organic certification."

A positive outcome already noted was that at least three business opportunities related to organic produce were created and at least four operations became certified organic.

We were surprised at the extremely enthusiastic reception our group of specialty crop growers received from H-E-B. In our meeting with H-E-B we were interested to learn that the company is still in the early stages of ramping up promotion and sales of organic products, due to an extremely strong demand from consumers. During the grant period, H-E-B started an aggressive ad campaign promoting organic products in every part of the store: dairy, produce, etc.

We learned a great deal about electronic newsletters and intend to continue the *Texas Organic Chronicles* newsletter with other funding sources. We learned that electronic newsletters are an inexpensive way to reach and educate large numbers of people.

NCAT organized a meeting between organic growers and produce buyers from Whole Foods, but Whole Foods staff cancelled the meeting, because of some last-minute staffing changes. This was a disappointing and unexpected result.

We were informed about our project funding very late, and so the original year-long timeline that we had proposed needed to be compressed into about six months. This complicated many project activities. For example, we missed a number of trade association meetings where we had planned to have a presence. We appreciate TDA's flexibility in allowing us to adjust our workplan.

For the same reason we had some difficulty measuring increase in learning or understanding about organic certification. We had originally planned to measure pre- and post-event levels of understanding at several workshops but had to change our approach to an electronic questionnaire because of the shortened timeline and our reduced workshop speaking schedule. We had a fair response to our May/June questionnaire measuring people's baseline level of understanding, but a very poor response rate to the follow-up questionnaire we did at the end of the project.

All in all, we would sum up by saying that response to project activities was strong, and there is certainly potential for many related educational efforts on organic certification and production in Texas.

Additional Information

All issues of the *Texas Organic Chronicles* have been archived and are available at https://www.ncat.org/texas-organic-chronicles/.

Our two webinars on organic certification are available as YouTube videos and may be viewed at https://attra.ncat.org/video/.

The free publication *Organic Specialty Crop Production in Texas: a Grower's Handbook* is available at https://attra.ncat.org/.