

FY 2011 SPECIALTY CROP BLOCK GRANT PROGRAM – FARM BILL

WASHINGTON STATE DEPARTMENT OF AGRICULTURE FINAL REPORT AMS Agreement: 12-25-B-1262

PROJECT COORDINATOR

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PROJECT #1

Project Title: Celebrity Chef Fruit Promotion Road Show in Indonesia

Partner Organization: Washington State Fruit Commission (WSFC)

PROJECT SUMMARY

This joint activity included Northwest Cherries (WSFC/NWCG), Washington Apples, and Northwest Pears. WSFC/NWCG requested WSDA Specialty Crop Block funds to create a PR event to build consumer awareness and increase product distribution in Indonesia, an emerging market with immediate potential of increased sales opportunities. Increasing the export market base is imperative for the Washington cherry, apple and pear growers for positive ROI.

Indonesia is an emerging market and all global economic forecasts indicated this to be an opportunity for market expansion. The project took advantage of the positive momentum created by a MAP funded US Fresh Fruit Showcase activity conducted in Indonesia in 2009-10. To add to that momentum, in June 2010, with the aid of Federal Emerging Market Program funds, NW Cherries conducted training seminars in Jakarta for the Trade to educate them of proper care and handling techniques for a highly perishable fruit, varieties, seasonal timing, and financial opportunities associated with cherries. In 2010, NW Cherry exports to Indonesia increased from a historical average of 300 boxes (20# equivalents) to 3,413 boxes and increased the market 77% in 2010-11 for Pears and Apples.

PROJECT APPROACH

The Washington State Fruit Commission contracted Kafi Kurnia, PT Peka Sadra Adhike Company (referred to in this report as Kafi) to execute this project.

Two Celebrity Chefs were contracted to do PR based cooking demos using Washington apples and pears as the first of two segments of this project: November 2011-February 2012 for apples and pears. Master Chef Vindex Tengker, the Indonesian Master Chef Judge, performed cooking demos in the cities of Bandung and Surabaya. Chef Master Vindex Tengker is one of three judges for a popular television program "Indonesia Master Chef". He is also a chef at the Bali Dynasti and the Amandari Hotel. Master Chef Vindex has held the responsibilities as Sous Chef Four Seasons Los Angeles, Executive Sous Chef Four Seasons Jimbaran, Resort Chef Four Seasons Sayan, Restaurant Chef at Restaurante Nusa Dua Mallorca Spain, and the President of Chef Association Jakarta (ACP). He consults with Restaurants, etc. and has been a guest on the cooking show in Indonesia called "Now" which airs on Metro TV.

Master Chef Vindex also performed cooking demos inside retailer produce departments and other PR events. Various media were in attendance and the estimated media exposure achieved is valued in excess of US\$20,000 in various printed and on-line media. Our target was US\$35,000+ in the first round of promotions which ran through February. On the next page are pictures of Chef Vindex during in-store cooking demos and PR events.





Also in this first segment, a second chef, USDA Chef Council Haryanto contracted with for three cooking activities in December, one in Jakarta outlying areas of Jakarta in Djogdjakarta and Bali. He is a well known alumnus of Tourism Academy of Trisakti University, Jakarta. He has several local and international culinary courses in Jakarta, Bangkok, Men-China, Zhucou-China, Manila and Singapore. He also conducted a Mrs. Tuty Soenardi for a television program “Seni Memasak Sehat” (The Cooking) and “Dapur Kita Dapur Sehat” (Our Kitchen is a Healthy SCTV. He is also a frequent contributor of articles and recipes for local including Nova Tabloit, Majalah Selera (Taste Magazine), Majalah Indonesia and Pastry Bakery. He is a frequent lecturer for courses at schools in Indonesia. He is a recognized leader of baking associations groups and often serves as a technical translator for International cruises. Most recently, he was a baking consultant at Goodman Fielder booth at the Philippines Bakery Fair in Manila.



Makmoer, was and two in the chef who is an participated in Paris, Taipei, Jiang culinary demo with Art of Healthy Kitchen) for print media Santap, Baker several culinary and other baking



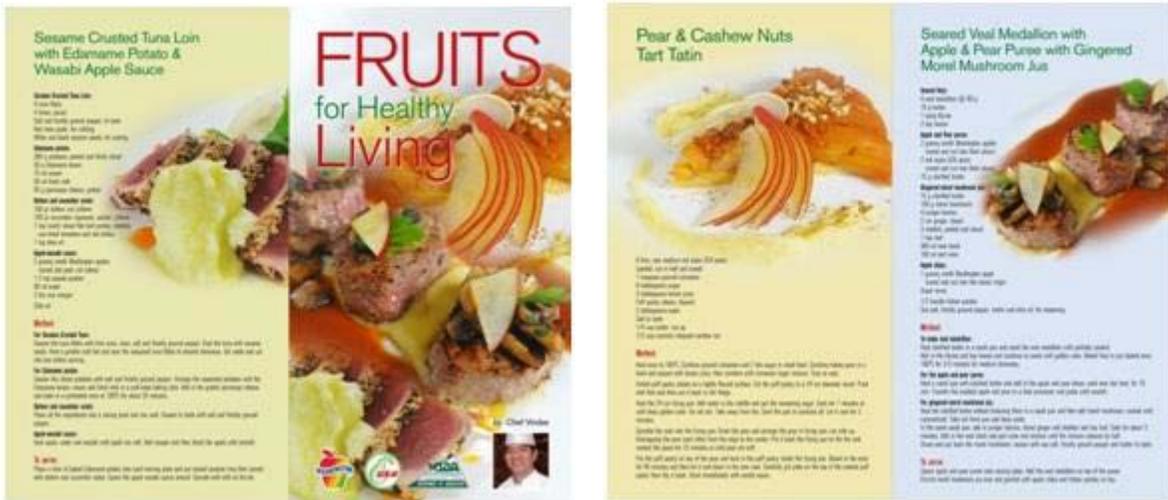
Chef Haryanto Makmoer – Jakarta





Chef Haryanto Makmoer – Bali

In addition to the chef pr/cooking events, WSFC also implemented a joint menu promotion with the Indonesian Cafe and Restaurant Association. We were able to negotiate a menu promotion with 19 restaurant chains in Surabaya (East Java). Of those 19 chains, 35 outlets participated in the "Apple & Pear Fiesta" promotions for one month. Each outlet created a unique recipe using Washington apples and pears to highlight for one month. For this promotion we also produced banners, tent cards, table mats and recipe booklets.





With our joint collaboration with the Indonesian Chef Association and the Indonesian Association of Cafe and Restaurant - Chapter Surabaya - East Java, we were careful to include more than 12 varieties of Washington apples and pears in the promotions. Our in-country representative also took the step to insure that the varieties being promoted were being imported by the importers and available in retail outlets for the consumer. Our in-store sampling joint promotions were actually implemented with 154 store outlets of 5 major Indonesian retail chains.

Chain	Retail	Number of Stores	Period	Volume moved before promotion	Volume moved during promotion	% increase sales
Ranch Market		10	Nov 15-Jan 15	2,100	2,894	37%
The Foodhall		14	Nov 8 - Jan 15	2,520	3,452	36%
Hero Supermarket		39	Dec 5 - Jan 15	6,435	8,365	30%
Kemchicks Supermarket		2	Nov 14 - Dec 13	420	589	40%
Hypermart		89	Nov 28 - Dec 18	12,015	16,028	33%



These promotions and other USA Pear promotions helped to increase total USA Pear volume to Indonesia by 23.7% in 2011-12 over the 2010-11 seasons. USA Pear sales increased 2.0% for the same period. WAC reports that their growers/shippers experienced a 4.8% drop in volume but offset that with an increase of sales dollars by 6.1% for this same segment period.

For the second segment of the project, June - August, our promotions featuring cherries and apples continued with the contracted Celebrity Chef, Master Chef Vindex and a new chef, Chef Karen Carlotta, owner of a successful bakery. Capitalizing on an gratis opportunity that arose from our strong connections with the retailers, our in-country representative was able to get The Celebrity Texas Chef - Cowboy Jay McCarthy to do joint cooking demos in The Foodhall in June. We also obtained the gratis services of Chef Adhika Maxi in August. Chef Adhika performed cooking demos in the Farmers Market Retail Chain in Kelapa Gading, Jakarta. Our cooking demos with Chef Vindex continued to raise awareness of our products. Below is a picture of Chef Vindex in the Living World retail outlet on June 14th.



*Celebrity Cowboy Chef - Jay McCarthy
During a cooking demo in The Foodhall retail chain, during
a soft launch promotion of Washington apples, fresh sweet cherries and USA beef.*



Second quarter in-store samplings ran in conjunction with the cooking demos with 6 retail chains: Farmers Market, Ranch Market, The Foodhall, Hero Market, Living World and the Trans Studio Mall. More importantly, our PR events reached out to the outlying areas of Jakarta, such as Kalapa Gading, Kebon Jeruk, Bandung, Surabaya, etc. Merchandising and display support was performed throughout the promotion segment with all of these chains resulting in WAC growth from the previous segment volume of <4.85%> to a +25.9% increase in volume over the same period a year ago. Their sales increased 40.3%. Cherries experienced a 60.1% increase in volume and a 26.5% increase in sales over the same period a year ago.

Project partners, the Washington Apple Commission (WAC) International Marketing Director, Rebecca Lyons, and the Northwest Pear Bureau (NWPB) Director of International Marketing, Jeff Correa met with the in-country project contractor, Kafi Kurnia, Senior Partner of PT Peka Sadtra Adhika company in Hong Kong in mid September 2012 during the Asia Fruit Congress convention to review the results of the Celebrity Chef promotion. They both gave positive responses to the program results. Both WAC and NWPB have separate promotional programs in Indonesia and share similar market presence timing. Indonesia is a major export market for both the WAC and NWPB and their expensive market knowledge was valuable in making choices that would get the best ROI.

GOALS AND OUTCOMES ACHIEVED

Increasing consumer awareness helps to increase product distribution. Because Indonesia is a developing market, our mission to introduce our products was successful and the long term achievement should be continued market growth for years to come.

The PR event activities were vertically integrated to obtain positive results for increased market share. For cherries, the goal was to increase cherry consumption in volume and value. The volume increased 60.1% from 3,265 cartons to 5,228 cartons and the value increased 26.5% from \$146,194 to \$184,969. This goal was met. The second goal was to increase retail sales which were also accomplished with a 64.5% increase from an estimated \$509,977 to \$838,895.

For apples, the goal was to increase apple consumption in volume and value. There are actually two segments for apples and the results were a negative 4.8% decrease in volume in the Nov - Feb segment from 841,986 cartons to 801,731 cartons that did, however, have a +6.1% increase in value from \$15.4 million to \$16.4 million. The second segment for apples was June - August with the volume of apples jumping 25.9% from 635,032 cartons to 799,788 cartons and sales jumping 40.3% from \$11.6 million to \$16.3 million. These goals were also met. The second goal was to increase retail sales. The Nov - Feb segment did increase retail sales dollars 33.4% from \$1.1 million to \$1.5 million while the second segment, June - August, saw a 43.3% jump in retail sales from \$1.5 million to \$2.1 million.

For pears, the goal was to increase pear consumption in volume and value. The volume increased 23.7% from 18,624 cartons to 23,032 cartons and the value increased 2.0% from \$478,226 to \$487,954. This goal was met. The second goal was to increase a retail sale which was also accomplished with a 28.0% increase from \$432,710 to \$554,010.

There were two Expected Measurable Outcomes to this project. We were able to use actual industry data to track the volume and value benchmarks. The retail sales data was gathered by the in-country representative.

- Outcome 1 Performance Measure (PM). The goal was to promote and increase sales of fruits during the promotional periods.
 - The first target for this PM was benchmark + 25% increase in volume and value.
 - The second target for this PM was benchmark + 50% increase in retail sales.
- Outcome 2 Performance Measure (PM). The goal was to increase the different usage of product resulting in increased overall consumption and increased purchasing frequency.
 - The target to increase consumption was benchmark + 15%.
 - The second target to increase purchasing frequency was benchmark (3 times per month) + 15%.

For cherries, the Outcome 1 Performance Measure (PM) reporting period was June through August. The target for this PM was benchmark + 25% increase in volume and value. The second target for this PM was benchmark + 50% increase in retail sales. Both goals were met.

Target: to increase volume and value by 25%	2011 volume in cartons (20# equivalents)	2012 volume in cartons (20# equivalents)	% change	2011 FOB plant value	2012 FOB plant value	% change
Northwest Cherries	3,265	5,228	+60.1%	\$146,194	\$184,969	+26.5%

Target: to increase retail sales	2011 retail sales value	2012 retail sales value	% change
Northwest Cherries	\$509,977	\$838,895	+64.5%

For Washington apples, there are 2 reporting periods for the Outcome 1 Performance Measure (PM). The first period was from November 2011 - February 2012 and the second from June 2012 - August 2012. The target for this PM was benchmark + 25% increase in volume and value. The second target for this PM was benchmark + 50% increase in retail sales.

Target: to increase volume and value by 25%	Nov 2010 - Feb 2011 volume	Nov 2011 - Feb 2012 volume	% change	Nov 2010 - Feb 2011 value	Nov 2011 - Feb 2012 value	% change
Washington Apples - Period 1	841,986	801,731	<4.8%>	\$15,450,443	\$16,387,382	+6.1%
Target: to increase volume and value by 25%	June 2011 - August 2011 volume	June 2012 - August 2012 volume	% change	June 2011 - August 2011 value	June 2012 - August 2012 value	% change
Washington Apples - Period 2	635,032	799,788	+25.9%	\$11,652,837	\$16,347,667	+40.3%

Target: to increase retail sales	Nov 2010 - Feb 2011 retail sales value	Nov 2011 - Feb 2012 retail sales value	% change
Washington Apples - Period 1	\$1,112,685	\$1,483,958	+33.4%
Target: to increase retail sales	June 2011 - August 2011 retail sales value	June 2012 - August 2012 retail sales value	% change
Washington Apples - Period 2	\$1,501,368	\$2,151,726	+43.3%

For Northwest pears, the reporting period was for November through February for the Outcome 1 Performance Measure (PM). The target for this PM was benchmark + 25% increase in volume and value. The second target for this PM was benchmark + 50% increase in retail sales.

Target: to increase volume and value by 25%	Nov 2010 - Feb 2011 volume	Nov 2011 - Feb 2012 volume	% change	Nov 2010 - Feb 2011 value	Nov 2011 - Feb 2012 value	% change
Northwest Pears	18,624	23,032	+23.7%	\$478,226	\$487,954	+2.0%

Target: to increase retail sales	Nov 2010 - Feb 2011 retail sales value	Nov 2011 - Feb 2012 retail sales value	% change
Northwest Pears	\$432,710	\$554,010	+28.0%

To address the Expected Measurable Outcomes - Outcome 2 Performance Measure (PM), for cherries, the goal was to increase the different usage of product resulting in increased overall consumption and increased purchasing frequency. The target to increase consumption was benchmark + 15%. The target to increase purchasing frequency was benchmark (3 times per month) +15%.

Target: to increase consumption in ways other than the traditional usages by 15%	2011 consumption	2012 consumption	% change
Northwest Cherries	4%	14%	+10%

The reason we failed to reach the 15% increase is because our product is expensive to bake with. This goal may be obtainable if there was a larger budget to work with and the program could be repeated multiple years to create consistency.

Target: % of consumers who purchase more than 3 times per month	2011	2012	% change
Northwest Cherries	20%	27%	+7%

The NW cherry shipping season was disrupted in the peak of the season due to the requirements of fumigation, resulting in a market with short supply. Market access contributed to the failure to reach the set goal.

For Washington apples, to address the Expected Measurable Outcomes - Outcome 2 Performance Measure (PM). The goal was to increase the different usage of product resulting in increased overall consumption and increased purchasing frequency. The target to increase consumption was benchmark + 15%. The target to increase purchasing frequency was benchmark (3 times per month) +15%.

Target: to increase consumption in ways other than the traditional usages by 15%	Nov 2010 - Feb 2011 consumption	Nov 2011 - Feb 2012 consumption	% change
Washington Apples - Period 1	22%	27%	+5% *
Target: to increase consumption in ways other than the traditional usages by 15%	June 2011 - August 2011 consumption	June 2012 - August 2012 consumption	% change
Washington Apples - Period 2	12%	9%	-3% **

*Indonesia consumers have a low habit for baking. Washington apples used for professional bakery are limited to the Granny Smith variety. The program needs to be repeated multiple years with other varieties such as Gala, Fuji and Honey Crisp.

**This promotional period was chosen for apples to correspond with the very short season of fresh sweet cherries out of the Northwest. The timing for Ramadan was in the peak of the promotional Period and retail trade shifted over to more traditional items such as dates which are very popular during Ramadan. The program needs to be expanded with better reach, targeting a promotional period around Ramadan and repeated for multiple years.

Target: % of consumers who purchase more than 3 times per month	Nov 2010 - Feb 2011	Nov 2011 - Feb 2012	% change
Washington Apples - Period 1	8%	13%	+5%
Target: % of consumers who purchase more than 3 times per month	June 2011 - August 2011	June 2012 - August 2012	% change
Washington Apples - Period 2	12%	17%	+5%

For Northwest pears, to address the Expected Measurable Outcomes - Outcome 2 Performance Measure (PM). The goal was to increase the different usage of product resulting in increased overall consumption and increased purchasing

frequency. The target to increase consumption was benchmark + 15%. The target to increase purchasing frequency was benchmark (3 times per month) +15%.

Target: to increase consumption in ways other than the traditional usages by 15%	Nov 2010 - Feb 2011 consumption	Nov 2011 - Feb 2012 consumption	% change
Northwest Pears	11%	12%	+1%

The reason we failed to reach the 15% increase is because NW pears are expensive for the professional bakeries to bake with and are expensive for most restaurants to use as an ingredient of their menu items. This goal may be obtainable if the program could be repeated multiple years to create consistency.

Target: % of consumers who purchase more than 3 times per month	Nov 2010 - Feb 2011	Nov 2011 - Feb 2012	% change
Northwest Pears	6%	10%	+4%

BENEFICIARIES

Indonesia is an important market for the Washington growers of pears, apples and cherries. This activity positively impacted the state’s 1,600 pear growers, 3,500 apple growers and 2,500 cherry growers in three ways: 1) immediately through increased sales during the promotional period; 2) in the long-term by incorporating promotional support for the leading super/hypermarket chains through the in-store chef demonstrations, thus building stronger relationships and 3) with increased consumer awareness of the multiple attributes of pears, apples and cherries and expanded usage ideas, continued product consumption beyond the promotional period.

In terms of the economic impact to the state, the three fruit industries represent over \$2.25 billion in revenue for the growers and constitute 5.25% of all of Washington’s food and agriculture revenue. A large scale promotion such as this helps the NW fruit industry build a stronger promotional presence, ultimately increase demand among consumers and lead to better prices and ROI for our growers.

LESSONS LEARNED

Offer insights into the lessons learned by project staff as a result of completing this project. Include the positive and negative results and conclusions of the project.

Through the expertise of our contracted in-country representative, Peka Consultants, Kafi Kurnia, the program and events were very smooth. This company is very experienced in these types of promotions.

Our goal to increase different usage of product resulting in increased overall consumption and purchasing frequency was extremely difficult to measure in those terms. But our increase in volume of each of the fruits, shows the overall intent to build the market was achieved thus we either reached new consumers and/or our consumers tried new recipes and bought more fruit.

CONTACT INFORMATION

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ADDITIONAL INFORMATION – See Attachment A 12-25-B-1262 Fruit

Provide the total level of cash or in-kind matching donations utilized for your project. Describe the amounts, sources and ways in which the donations were utilized.

The in-kind match for this project was from WSFC in \$6,500.00 for salaries and program implementation. WSFC is funded through cherry assessment income per RCW15.28. The anticipated cash match per the agreement of \$5,000 was not paid because our representative in Indonesia for this project did not do give-aways which this money was targeted for. The other cash match of \$2,500 for travel was not paid because representatives from WAC and NWPB used their trip to Asia Fruit Logistica for the program review. The International Program Director for the WSFC made a trip to Indonesia in the late summer of 2011 but the trip was taken before the SCBGP grant was implemented.

<http://www.okefood.com/read/2011/12/27/299/547969/olahan-buah-makin-disukai>

<http://www.surabayapost.co.id/?mnu=berita&act=view&id=b2438338df6b8945c6b8491a48ec2444&jenis=c81e728d9d4c2f636f067f89cc14862c>

PROJECT #2

Project Title: Technology Transfer for Sustainable Cranberry Production

Partner Organization: Pacific Coast Cranberry Research Foundation (PCCRF)

PROJECT SUMMARY

Background

The PNW cranberry industry is characterized as mainly small farms with outmoded production practices, undefined irrigation management strategies, and anachronistic pest management concepts. Because of the cost to renovate and modernize a cranberry bed, many of these farms have changed little in the past 30 to 50 years. Furthermore, with nearly all growers employed off the farm and with the median age of growers over 70, these industry demographics have been obstacles in the adoption of contemporary practices. Pesticides are still applied through irrigation systems (chemigation) that have poor distribution uniformity. Chemigation systems are also far from being compliant with federal and state regulations that govern chemigation. Efforts to mitigate surface water contamination with pesticides applied through chemigation systems are being addressed by a long-standing USDA-NRCS Environmental Quality Incentive Program (EQIP) for drainage ditch cribbing and covering, but these have failed to prevent regulatory violations.

A concern that has not been addressed by the EQIP project is compliance with chemigation practices and with pesticide storage. These issues are jeopardizing the livelihood of cranberry growers and imperiling the longevity of the cranberry industry. If current production practices and pest control concepts are not superseded, regulatory intercession arising from pesticide impacts on threatened and endangered aquatic species and exceedance of surface water quality numeric standards will seriously restrict pesticide availability and use, impede management options, and increase economic uncertainty. There are also social implications in addition to the economic and environmental ramifications. The expansion of foreign cranberry acreage has created recurrent market surpluses and reduced grower returns. Washington State consistently has the lowest yields of all commercial growing areas in the USA. The socioeconomic demographic of Washington growers also confounds practice adoption and technology transfer.

Issues addressed by this program's training and outreach.

Reducing Regulatory Barriers: No Global G.A.P. certification, and exceeding low international maximum pesticide residue levels (MRLs) are major issues affecting export of cranberries to many countries.

Controlling Pests & Diseases: Poorly designed and inadequate irrigation and chemigation systems greatly contribute to reduced pesticide efficacy, poor production, and violation of TMDLs (Total Maximum Daily Loads) in surface water.

Improving Food Safety: Third-party certification programs are being used to mollify buyer concerns regarding food safety and employee welfare.

This project was motivated by both economic and environment stressors. Specifically, the industry was under very close regulatory scrutiny for violation of water quality TMDLs and difficulty in adhering to chemigation practice standards and pesticide use regulations. In addition, a surplus in global cranberries has diminished grower returns, making compliance more difficult. A project that would assist growers in achieving compliance with regulatory issues, in improving crop marketability, and augmenting grower returns was of critical importance.

This project was not previously built on another Specialty Crop Block Grant Program project.

PROJECT APPROACH

Activities and Task	Results & Accomplishment	Conclusions and Recommendations
Retrofit of the irrigation system at the Pacific Coast	The extensively renovated irrigation system was design by USDA-NRCS and installed primarily by local cranberry growers. The irrigation system was	The Variable Frequency Drive (VFD) and its controller were not without problems. While saving in

Cranberry Research Foundation's research and demonstration facility	demonstrated to growers at the 2013 Cranberry Field Day.	power cost, and providing great flexibility in irrigating and chemigating and heat/frost protection, its expense and complicated operating systems was problematic. A simplified system would be recommended for all but the largest of cranberry growers.
Installation of radio controlled sensing stations and a wireless cellular connection to collect real-time soil moisture, electrical conductivity, and air and soil temperature.	The sensors were installed in the bogs and demonstrated to growers.	The particular unit selected for this project was to elaborate and costly for most growers. However, the concept has proven to be very useful, and numerous growers are installing equipment similar to the project unit. As use is better defined, monitoring sensors will be recommended more. Using electrical conductivity measurements to schedule fertilization of new plantings should be developed.
Grower workshops	6 workshops and 4 field days were held to provide outreach to growers on information resulting from this project. Outreach efforts provided information to growers in Washington, Oregon, and British Columbia.	Structured and informal surveys used to document outreach efforts revealed that outreach efforts were successful conveying information to growers and instigating practice adoption.
Video outreach	In-field videos were made and posted to the WSU Long Beach website. Topics included include sweeping for cranberry pests, direct injection vs. satellite injection irrigation, soil tensiometer placement, and variable frequency drive (VFD) applications for cranberry irrigation.	The usefulness of the demonstration videos have yet to be appreciated, as they have only been up for a short time. Nevertheless, they will remain a long term asset to growers seeking more information on these topics.
CranG.A.P.	A cranberry processor-based USDA CranGAP certification was developed for fresh fruit growers. All of the cooperative's growers were audited in 2014. All of the audited fresh fruit growers passed the inspection.	This was a cooperative driven project. It was a good transitional process for growers to experience as a prelude to GlobalG.A.P. certification.
Global G.A.P.	A Global G.A.P. manual for cranberry growers was developed. It has been posted to the WSU Long Beach and is currently being used by growers. An intensive GlobalG.A.P. certification training was conducted in Grayland to 14 growers. Modules included Integrated Crop Management (ICM); Integrated Pest Control (IPC); Quality Management System (QMS); Hazard Analysis and Critical Control Points (HACCP); worker health, safety, and welfare; and environmental pollution and conservation management.	A majority of growers (80%) who attended subsequently achieve Global G.A.P. certification. This has resulted in them being able to sell fresh fruit to previously unavailable markets. This in turn has prevented them from losing the farm. Although a daunting process, having the first set of growers pass the Global G.A.P. certification will be key to attain grower-wide

		compliance when time is ready. The Cranberry GlobalG.A.P. Manual is available on-line and will be used by PNW growers as they pursue certification. Additional efforts on GlobalG.A.P. training can be done in-house by other growers who have gone through the process. An Oregon-based company is using the manual to prepare its growers for certification.
GlobalG.A.P. training inspection	A GlobalG.A.P. audit was conducted on a cranberry farm as a hands-on training exercise. Attending growers learned about the inspection process and performance critical necessary to pass field and warehouse inspections.	Witnessing the process and responding to procedural assessments afforded growers with an experiential opportunity to simulate a mock audit. The experience will be vital in preparing grower for and to pass an inspection. Repeating this process yearly is recommended as more processors require GlobalG.A.P. certification.
Domestic and overseas MRLs	Field residue data were collected on pesticides that constitute the biggest MRL risk for the EU marketplace. These were presented to growers in numerous outreach formats.	Bravo, Lorsban, Orthene, and Admire have been all problematic. Preharvest interval dates for growers to time the use of those chemistries were recommended as a means to prevent tolerance exceedance.
Pesticide container collection and disposal	A pesticide container disposal and recycling program was initiated. Two collection sites have been organized to serve the growers in the Long Beach and Grayland areas.	Previously, an empty pesticide container program has not existed. With the coordination of this project, empty pesticide containers have been deposited by growers and the first large (semi-load) pick has already been conducted. This program will be continued and will be very valuable in the future.
Waste pesticide collection	Although not a part of the project, it was dovetailed into the program as a result of the growers needing to pass USDA GAP or GlobalG.A.P. certification. These programs require the proper disposal of waste pesticides.	There were 27 storage sheds, involving 22 growers, in the waste pesticide cleaned up program. Over 28,000 pounds net weight of pesticides were collected and properly disposed. Grower trust was established. Additional removal programs are currently scheduled.
Safety posters	English/Spanish GRASP poster (that display information about Worker Right to Know, employee rights, minimal wage, unemployment benefits, and migrant and seasonal Ag worker protection act) were obtained and distributed to workshop attendees.	Posting of these were required for GlobalG.A.P. certification. The posters contained safety and worker rights information required for passing inspection. Growers have

		found the posters to be very useful.
Pesticide storage shed	A needs assessment was conducted to determine designed and placement standards for a pesticide storage shed to be compliant with GlobalG.A.P. criteria. However, existing USDA-NRCS engineering design for cost-sharing was unsuitable for cranberry growers. In response to a request, the minimum setback distance in NRCS Practice Standard 309: Agrichemical Handling Facility was revised. Resources were used contract with a professional engineer to design structures suitable to small, medium, and large scale growers. Engineering drawings of the sheds will qualify for NRCS cost-sharing and comply with GlobalG.A.P. criteria.	A copy of the engineering plans is on-file with USDA-NRCS and has been posted to the WSU Long Beach server. The certified designs will be invaluable in the future to growers as they renovate existing pesticide storage facilities.
Chemigation demonstration unit	A mobile unit was design (by the project team), built, and demonstrated to growers. The mobile unit was fundamental in validating the advantage to inject at the bogs by means of satellite injection points. An increase in pesticide efficacy has been noted.	The unit was over-designed, given the need of most growers. Nonetheless, several growers have purchased similar units or have constructed simpler units capable of performing the same functions.
Chemigation system calibration training and demonstration	Demonstrations were conducted on techniques to calibrate injection rates for chemigation applications.	A grower survey indicated that most 71% of growers used a dye test (the preferred method) to calibrate their chemigation system, and 17% used a visual assessment.
Chemigation equipment compliance	Responding to a survey, nearly 97% of cranberry growers' chemigate. Demonstrations were performed at grower field days, reference materials were distributed at grower meetings, and articles included in the <i>WSU Cranberry Vine Newsletter</i> on federal and state requirements for chemigation systems. Several on-farm visits were done to assess system compliance.	Currently, it is estimated about 25% of growers in the Grayland area chemigate with systems that are compliant with federal and state regulations. An outcome of WSDA inspections of these chemigation systems, compliance among Grayland cranberry growers is anticipated to be nearly 60% by early 2015. Full compliance will be achieved by early 2016.
Irrigation sprinkler head assessment	All the manufactures of sprayheads used by cranberry growers were contacted to obtain sprayhead models. The heads were installed on different beds for demonstration and uniformity comparisons during several field days.	Based on these demonstrations and comparative assessments, growers have selected better performing sprayheads to update irrigation systems in existing beds. These modern, newer type sprayheads are being installed in renovated beds and in all new beds. The sprayheads provide better uniform distribution for irrigation and, consequently, chemigation.
Irrigation distribution uniformity assessment	In response to a survey question, 38% of growers claim to use a cup test method to evaluate irrigation uniformity.	Several growers changed sprinkler heads across their beds as a result of

	Offers were made to assess irrigation distribution uniformity on grower's beds. Unable to respond to all the requests, a majority of the assessments were completed. It was determined from these assessments that grower systems were much less efficient than reported, with most being 10 to 15 percent less. Most systems did not adhere to the 85% distribution uniformity standard for solid set systems, despite grower assertions. Recommendations were made to improved system uniformity. To facilitate calculating distribution uniformity, an Excel spreadsheet was developed and distributed.	the uniformity assessment. Other growers were made aware of design faults and have adjusted irrigation and chemigation practices to better accommodate for poor uniformity. The Excel-based application was shared with growers in other production areas within the U.S. and Canada. It is the only application in existence that calculates distribution uniformity on solid set systems.
Irrigation sensor testing	Several types of soil moisture monitoring devices were demonstrated. Several monitoring systems were tested on and off the PCCRF research farm. Results suggestion over-irrigations is still commonplace.	No one system met the needs of the cranberry industry. Manual or automated tensiometers were adequate, but were awkward to use and posed other complications. However, tensiometer readings corresponded best to the water needs of the plants on sandy soils.
Frost protection sensor testing, alternative frost protection methods	Different temperature sensor technologies and wireless frost protection alert systems were demonstrated. The use of wind machine for frost protection was demonstrated and evaluated.	Many growers have transitioned to supplemental sensor technology, especially for frost alerts. This will become standard industry practice within the decade. The wind machine was not a viable option for cranberry growers due to cost and to functionality given bed layout.
WSU AgWeatherNet station in Grayland	An AgWeatherNet station was installed in the Grayland area to provide growers with critical, real-time climatological information need for irrigation, and frost and heat protection. To assist growers in extrapolating weather station data and in applying information to their individual farms, a dozen remote temperature data loggers were employed throughout Grayland area for comparative purposes.	The station was not installed early enough to benefit growers during the 2014 season. Outreach efforts will be required in the future to help growers locate, interpret, and apply climatological data and to utilize predictive functions and temperature-based models.
IPM outreach	New scouting and monitoring equipment was procured for the PCCRF to provide better IPM service to the industry service.	This has been and will continue to be extremely valuable for IPM scouting on cranberry Tipworm. This pest is barely visible to the naked eye, and requires detailed monitoring work not assessable to growers. Tipworm has and will continue to cause considerable crop damage.
Cranberry Reference CD	Responding to the need for a comprehensive anthology of cranberry production information, a search of research and extension programs throughout North America was performed. The resulting Cranberry Reference CD is a compilation of publications, presentations, and	More than 150 CDs were distributed to cranberry producers. The British Columbia Cranberry Growers Association requested a master copy of the CD from which copies were

	photographs. In total, 149 credible references were identified from six universities, four federal and State agencies, three cranberry associations, and Agriculture and Agri-Food Canada.	made and distributed to its membership. It is proposed that the CD will be updated to include information from projects arising from the Specialty Crop Block Grant.
WA Interim Standard 775: Drainage Ditch Cover	An engineering control to mitigate pesticide detections in the Grayland Drainage Ditch, growers have been cribbing and covering bog draining systems. Installation has been done with cost-share from USDA-NRCS. However, the practice standard had expired, and cost-sharing of a structure cannot be done on a management practice. An interim standard (Code 775) was proposed and accepted.	The USDA-NRCS Interim Standard 775 will allow conservation district's to cost-share with growers in the installation of cribbing and covering structures. The interim standard is permissible for three years. Approximately 20 percent of Grayland growers must still install cribbing and covering on their bogs.

Partners	Role and Contribution
Kim Patten, WSU Extension	Project leadership, oversight, research and outreach
Tom Hoffmann, WSDA	Project leadership, oversight, and outreach
Leigh Nelson, USDA-NRCS Statewide Irrigation Engineer	Project outreach for design and acquisition of the new irrigation technologies, specifically irrigation system for the PCCRF
Troy Peterson , WSU Extension Irrigation Specialist	Project outreach for irrigation technology
PCCRF Board of Directors	Project support and direction, and oversight
Mikel Burns, PCCRF accountant	Project financial supervision / management
Nick Haldeman and Chase Metzger, WSU Research Technicians	Project outreach, research, and implementation
Nicole Brunner, WSHA Gras2p Coordinator	GlobalG.A.P. program training organizer /provider
Taylor McMillen, BSI America Food Verification Services, Inc.	Global G.A.P. Certification Trainer
Malcolm McPhail, grower, PCCRF board	Project oversight, in-kind labor and equipment for project implementation
Nancy Delvin, grower, GlobalG.A.P. local coordinator	Review and edited GlobalG.A.P. documents; assisted and coordinated with GlobalG.A.P. program implementation
Mark Leingang, TransOlympic Engineering, Inc.	Engineer with design firm for pesticide storage structure
USDA-NRCS State and Regional staff (Molly Dawson, Nick Somero)	Review of project design specifications for pesticide storage structure

This project did not benefit any non specialty crops; it only benefited the cranberry industry.

GOALS AND OUTCOMES ACHIEVED

Outcome 1: Increase awareness of alternative cost-effective methods to achieve chemigation compliance and irrigation distribution uniformity.

Numerous outreach efforts were made to enhance awareness and offer grower-assisted assessments. Our target was to achieve >80% growers with a high level of awareness. Although this number is hard to accurately quantify, more growers are talking about compliance and irrigation uniformity than previously, and surveys indicate that we have achieved that goal. Since the demonstration of the mobile chemigation unit two years ago, A&L Supply (fabricators of the unit) has received orders for four units similar to the demonstration unit. Furthermore, numerous other growers have built their own chemigation units. Using dye to demonstrate the detrimental effect of run times (point of injection to first nozzle in beds) on pesticide efficacy, growers are installing satellite injection points at individual beds. A longstanding but illegal practice, growers are modifying their chemigation systems to relocate the injection port from suction side of the irrigation pump. To achieve compliance with federal and state regulations, growers in the Grayland are renovating their chemigation systems with alternative injection systems, including Venturi devices and positive displacement pumps.

The project team in collaboration with USDA-NRCS and WSDA devised an engineering schematic for a barometric loop as an alternative device to the irrigation mainline check valve. The barometric loop exceeds criteria specified by the U.S. Environmental Protection Agency when used for chemigation. Owing to its simplicity and low cost, it is the preferred system among cranberry producers to meet the intent of the Washington State Chemigation Rule.

Outcome 2: Develop an audit tool to be used by growers to assess production practices relative to established environmental and sustainability standards.

Ocean Spray Cranberries, Incorporated, has coordinated and implemented an audit verification program with a focus on best agricultural practices to verify that cranberries are produced, packed, handled, and stored in the safest manner possible to minimize risks of microbial food safety hazards. All the Cooperative's fresh fruit growers passed the USDA CranGAP audit. This was achieved with a tremendous invest in time, effort, and resources by the Cooperative. This training was attended by 90% of the independent cranberry growers in Washington. All the major fresh fruit growers were inspected under USDA GAP audit criteria and are likely to pass (final results pending). Anticipating the adoption of the only internationally accredited certification program; a GlobalG.A.P. standard for the cranberry industry was developed. Training was provided on the certification protocols and audit process.

Outcome 3: Increase grower likelihood of adoptive compliance practices.

Cranberry growers in Washington State are striving to be compliant with federal and state laws and rule that regulate pesticide use. Attentiveness to and adherence with pesticide regulations are based farm inspections by WSDA Pesticide Compliance Unit, participation in waste pesticide collection programs, implementation of a pesticide container recycling program, outcome of WSDA surface water quality monitoring in the Grayland area, and assertions in grower surveys. Compliance also depends on which practice. Some of the easier ones have a high rate of adoption (e.g., IPM, pesticide storage clean-up, assessment of irrigation distribution uniformity, and verifying chemigation calibration). Those requiring considerable fiscal expenditures, like chemigation equipment installation and retrofit, are less successful, but are still improving. With the revised USDA-NRCS pesticide storage standard, the availability of building schematics designed by a professional engineer, and access to cost-sharing through USDA-NRCS EQIP, the feasibility and likelihood of compliance with pesticide storage will increase.

Outcome 4: Develop incentive-based, cost-share program.

This outcome was limited to agrichemical handling facility. This was complicated by USDA-NRCS Conservation Practice Standard 309 that required a 100-foot setback distance from a surface water body. The setback was untenable for cranberry growers. However, USDA-NRCS revised the standard, incorporating a setback provision of 10 feet that is specific to cranberry farms. The structure design team and a civil engineering firm applied the revised practice standard in developing engineering plans that are compliant NRCS specifications, and thus permissible for cost-sharing.

Outcome 5: Increase the number of irrigation systems with a distribution uniformity that correspond to NRCS standards.

This outcome is approaching completion. Several farmers signed up for free distribution uniformity assessments, and many more are completing them on their own. The general criteria for distribution uniformity are based on USDA-NRCS Conservation Practice Standard 442: Irrigation System, Sprinkler, which is 85 percent for solid set systems. Distribution uniformity is critical for frost control, plant cooling, pesticide and fertilizer efficacy, and supplemental water applications (based on evapotranspiration). As irrigation uniformity becomes more of an issue affecting the cranberry growers' bottom line, more irrigation system assessments will be completed.

Outcome 6: Increase the number of cranberry farms that are in compliance with regulations governing pesticide use and chemigation.

When conducting ag use inspections, WSDA Compliance Unit staff evaluate the application process and apparatus configuration and assess applicator knowledge regarding pesticide label instructions and state pesticide regulations. Also, GlobalG.A.P. compliance criteria specify that plant protection products be used in accordance with label instructions. WSDA is currently conducting Ag use inspections on cranberry operations in the Grayland area, which includes an assessment of chemigation systems. Approximately 25 percent of chemigation applications are currently compliant. Using compliance inspections and outreach efforts, 65 percent compliance will hopefully be achieved by early 2015. Full compliance is targeted for early 2016.

Long Term Expected Measurable Outcomes	Summary of Progress
Cranberry farms exceeding USDA-NRCS distribution uniformity standards for irrigation (Code 442).	Growers are aware of the standard. Distribution uniformity standards are exceeded in new bed renovations. However, due to cost of renovations and to low crop prices, progress towards this outcome will be slow.
Cranberry farms in compliance with pesticide regulations, especially chemigation.	Incited by certification compliance criteria in USDA GAP and GlobalG.A.P. compliance with pesticide regulations has been emphasized among fresh fruit growers, and progress is being made. Many fresh fruit growers have achieved compliance. Additional compliance is being accomplished by means of WSDA inspections.
Project Activity	Accomplishments
Organize Technology Assessment & Project Outreach Team	Achieved
Provide on-going outreach on specific components of project using meetings, email, websites, field days, and workshops	Achieved
Assess PCCRF irrigation and chemigation systems	Achieved
Evaluate irrigation distribution uniformity, chemigation efficiency, and pumping efficiency across multiple grower sites	Yes, but not fully completed due to Project Coordinator leaving
Design, construct, and demonstrate a chemigation demonstration unit	Achieved
Install, test, and demonstrate irrigation backflow system, satellite injection points for chemigation, and pesticide storage equipment at PCCRF Research Farm. Compare the effectiveness and suitability of different chemigation units vs. grower standards.	Achieved
Write guidance criteria for cost-share incentive program	Yes (for Pesticide Storage)
Publish "Generally Accepted Ag Management Practices for Cranberry Production"	Project was modified when Ocean Spray Cranberries elected to develop its CranGAP audit verification program, a USDA GAP based scheme. Project team cooperated with Ocean Spray in instituting CranGAP.

Publish Cranberry Production Sustainability Certification		Achieved (published Global CranG.A.P.)
Evaluate adaption feasibility of innovative practices and ID technology transfer strategies		Partially achieved
Project Goals	Target	Accomplishments
Increase grower awareness of alternative cost-effective methods to achieve chemigation compliance and irrigation uniformity	>80 % growers with high level of awareness of viable alternative	This outcome has been completed, and there is >80% growers with high level of awareness. In addition, due to on-farm compliance inspections by WSDA Compliance Unit staff with Grayland growers, awareness is close to 100%.
Develop a self-assessment audit tool to be used by growers to evaluate production practices relative to established environmental and sustainability standards	30% of WA cranberry growers will complete the self-audit	This was achieved with the developed of two audit certification programs: Ocean Spray Cranberry's CranGAP and the project's Global CranG.A.P. 100% of fresh fruit growers were audit using either the USDA GAP-based CranGAP or the Global CranG.A.P.
Increase grower likelihood of adoptive compliance practices	>40%	With USDA GAP inspections of fresh fruit growers, compliance likelihood was assured for practices of major significance. This represents two-thirds of the industry.
Develop incentive-based, cost-share program	Write criteria by 12/2012 for 2013 proposal	This outcome was limited to just the agrichemical handling facility. USDA-NRCS adopted an exception specific to the cranberry industry. The exception reduced setback distance for a pesticide storage structure from a body of water from 100 feet to 10 feet. With the exception, a set of engineered plans, consistent with this goal, were developed.
Increase the number of cranberry farms that have irrigation distribution uniformity exceeding USDA-NCRS Conservation Practice Standard 442	>10% by 2013	On-going offers were made for growers to sign up for a free uniformity assessment. 85% of those requesting an assessment were completed. Outreach efforts on how to conduct an assessment with recommendations to achieve desired uniformity were conducted annually. An Excel-based application was developed to assist with calculations.
Increase the number of cranberry farms that are in compliance with pesticide regulations, particularly chemigation	>20% by 2013	100% of fresh fruit growers passed a USDA GAP inspection. WSDA compliance inspection in 2014 indicated that about 25 percent of farms were in compliance with chemigation rules. With outreach activities, compliance is anticipated to exceed 60% by early 2015, and full compliance expected by early 2016. Most systems will utilize the barometric loop to achieve compliance.
Expected Measurable Outcome Target	Baseline Data Gathered	Targets Achieved
>80% growers aware of alternative of methods to achieve chemigation compliance and irrigation distribution uniformity	Grower surveys were conducted for baseline; 38% of respondents used cup test method while 27% used a visual assessment, 35% never conducted an assessment. The baseline survey was specious in that an assumption was made that growers were adept with assessment methodology; they were not. In fact, grower assessments were 10 to 20 percent higher than actual.	The process was demonstrated twice: Long Beach and Grayland. The process was observed by at least 85% of WA cranberry growers. The process comprised a presentation at a workshop, as well. An Excel-based application

		was developed to assess with complex calculations, the first of its kind. Garnered from conversations, about 50% of growers have performed distribution uniformity assessments on bogs.
>30% of WA growers will use an audit verification tool to assess production practices relative to standards	No audit scheme existed from which to establish a baseline.	Two audit certification programs now exist. The project-developed Global CranG.A.P. and Ocean Spray Cranberry's CranGAP. Twelve growers completed the GlobalG.A.P. audit certification. 100% of fresh market producers completed the Ocean Spray scheme.
40% of growers likely to adopt compliance practices	Grower surveys conducted to set baseline with <10% of respondents indicating likely to adopt	From system inspections conducted by WSDA Compliance Unit staff, about 25% of chemigation systems are compliant. With outreach efforts, a goal of 65% compliance is anticipated by early 2015, and 100% by early 2016.
Develop an incentive-based, cost-share program	Relevant cost-share program assessed and pesticide storage facility was determined from a needs assessment	Collaborating with USDA-NRCS, untenable provision in Conservation Practice Standard 309: Agrichemical Handling Facility was resolved. A clause was added that is specific to cranberry operations to reduce setback from surface water bodies. A civil engineering firm has developed construction plans that are consistent with NRCS criteria, thus eligible for cost-share.
>10% of cranberry farms that have irrigation distribution uniformity	Conducted uniformity audits. <5% exceeded the USDA-NRCS standard of 76%	Post-irrigation system audit assistance with

exceeding USDA-NCRS Conservation Practice Standard 442		growers increased distribution uniformity to 80%. Essentially 100% of growers are aware of the standard.
>20% cranberry farms in compliance with pesticide regulations, especially chemigation	Self-auditing data for baseline data not available. Any data would be confounded in that growers are not aware of chemigation system requirements, despite their affirming assertion. WSDA inspections of chemigation system inspections estimated 25% compliance.	Prompted by WSDA outreach activities, compliance by Grayland producers is expected to be 65% by early 2015 and 100% in 2016.

BENEFICIARIES

Beneficiaries	Benefits
Washington cranberry industry	<ul style="list-style-type: none"> • Awareness of and training in new technology and equipment for irrigation, chemigation, soil moisture and frost monitoring, pest management, pesticide storage, and pesticide safety • Training in USDA GAP and Global G.A.P. performance criteria and knowledge of audit certification process • Access to new WSU Ag WeatherNet Station, Global G.A.P. Training Manual for cranberry production, educational videos, safety posters, USDA-NRCS specifications for pesticide storage shed, and industry-wide pesticide container disposal system
Pacific Coast Cranberry Research Foundation	<ul style="list-style-type: none"> • State of the art irrigation and chemigation system, and monitoring equipment to provide new capability for research and outreach • New IPM equipment for industry research and outreach
Surrounding communities	<ul style="list-style-type: none"> • Reduced environment risk to pesticide due improved IPM practices, waste pesticide disposal, and empty pesticide container recycling • Access to climatological information from WSU AgWeatherNet station near Grayland
Other specialty crop growers	<ul style="list-style-type: none"> • Agriculture Safety, Health, and Hygiene Video used by industry to comply with WA State Labor and Industries employee safety training, Pesticide Storage Shed Design for NRCS EQIP cost-sharing

This project emphasized mostly on transitioning the cranberry industry towards adoption of conventional production practices concerning irrigation and pest management. Adoption of new practices is a long-term goal and difficult to quantify within the scope of this project. Adoption of practices were quantified by grower surveys and by the number of grower participating in certain practices, such as waste pesticide collection program, empty pesticide container recycling, or passing USDA GAP or GlobalG.A.P. audits. These data were provided above. Appraised during the initial inspection, WSDA staffs determined about 25% of the chemigation systems in the Grayland area were compliant with federal and state regulations. With outreach activities, 100% compliance will be achieved in 2016. In this same area, grower practices in the storage of pesticide containers were fully compliant with state rule.

The economic impacts of the project can be described in enhanced crop production or increased crop value. The increased in project-related crop production is difficult to assess. On the other hand, there is a significant difference for USDA GAP and GlobalG.A.P. certified cranberries vs. non-certified. Ocean Spray Cranberries (hereinafter, cooperative) required all fresh fruit grower to pass a USDA GAP certification audit. The difference in the cooperative's pricing structure between process and fresh market is about \$0.15 per pound. Based on the average amount of the cooperative's fresh fruit grown in Washington State each year, this represents a \$0.5 million per year advantage to cooperative growers. For the non-

cooperative growers, the difference in price between processed and fresh is approximately \$0.45 per pound. This represents a \$0.25 million per year impact to non-cooperative growers in Washington. In summary, this project had considerable direct economic impact to the cranberry industry in Washington State.

LESSONS LEARNED

- Development of USDA-NRCS standards and specification for a cost-share program can accelerate practice adoption, and may often be the only way to obtain adoption or to transition practices.
- This project exposed the grower community to many new technologies that they could implement. Success of that implementation was limited if technology, such as irrigation and monitoring equipment, was not cognizant of or attending to the comfort level of the grower community. Simple, cost-effective technologies, on the other hand, were easily validated and quickly adopted.
- Early industry adopters and industry leaders are fundamental to practice acceptance and adoption.
- Educational outreach within an aged grower community cannot depend on technology, especially social media. Less than half of the industry was comfortable with email, and less than 3% were comfortable with Twitter.
- Technology transfer within an aged grower industry that is already marginally profitable is a slow process.
- Adoption of costly practices will only be successful if driven by the market or regulatory compliance. Self-certification, although useful, have limited usefulness – other than preparation for third-party audits.
- Market mediated compliance, such as GlobalG.A.P. requirements, is the most effective means to effect change and to implement industry technology transfer on a large scale. To a certain fraction of the grower community, the complexities of these requirements will remain too difficult and cumbersome to adopt, regardless of the training and resources provided.

Implementing high-tech irrigation pumps, controller and valves resulted in numerous system failures on the PCCRF farm, including one year of crop loss and numerous repair cost. These systems were not anticipated present operational problems that over-rode any of their many advantages. These problems would prevent grower from readily adopting this technology.

We only were able to obtain partial achievement of the following Outcome: Evaluate adaption feasibility of innovative practices and ID technology transfer strategies. Even with an extension, this grant was not long enough to properly evaluate all of the innovative practices and technologies we assessed and/or employed. Several were practices were able to immediately assess, such as portable chemigation unit. Others, like the Grayland AGWeatherNet station or Pesticide Shed design specification, will require a decade to assess how many growers use or implemented these practices/designs.

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ADDITIONAL INFORMATION – See Attachment B 12-25-B-1262 Cranberries

In-kind labor:

- Project outreach and oversight
 - Technology Transfer team meeting: WSU, WSDA and NRCS team - 100+ hours total (not used in match)
 - WSU Extension (not used in match)
 - Irrigation outreach - 40 hours
 - Pest management outreach - 40 hours
 - Project coordination and outreach - 100+ hours
 - NRCS (not used in match)
 - Irrigation systems - 40 hours for irrigation system design and review outreach.
 - Pesticide storage shed - 20 hours for design review
 - WSDA (not used in match)
 - Compliance inspections and outreach activities - 240+ hours

- GlobalG.A.P. process coordination, oversight, and review - 60 hours
- Resource development, educational material preparation, and outreach - 150+ hours
- Program coordination and stakeholder collaboration - 100+ hours
- Writing reports and correspondence - 45 hours
- GlobalG.A.P. coordinating with Grayland growers - 20 hours
- PCCRF
 - Project review and oversight by Board members - 60 hours
 - Grayland grower, Kevin Hatton, provide the land and maintenance for the WSU AgWeatherNet station in Grayland - 20 hours

In-kind Cash from PCCRF (Total: \$25,291)

- Accounting - \$2,252.16
- Fieldwork for irrigation system installation - \$9,984.00
- Equipment - Berkely pump at \$10,085.40
- Supplies - ATT contract at \$390.60

PROJECT #3

Project Title: Retail Training in Care, Handling and Merchandising – Seminars and DVD

Partner Organization: Washington Apple Commission (WAC)

PROJECT SUMMARY

Modern retailers (hypermarkets and supermarkets) in developing markets have limited exposure to the design layout and merchandising ideas of US fresh produce in their stores. Most of the fresh produce sections in these outlets are not designed to maximize sales. In addition, produce handling and training need to be intensified at the store level since most retail produce staff lack proper handling and merchandising skills. Modern retailers are increasing their share of fresh produce sales at the expense of traditional wet markets. Improved produce handling and display will accelerate this process. High quality Washington apples, Northwest Pears, Northwest Cherries and Washington Potatoes will be major beneficiaries of market share growth by the modern retail sector with our longer shelf life, better appearance, and timely delivery versus cheaper source origin produce that lacks the high quality image and characteristics of US produce.

PROJECT APPROACH

This was a two pronged effort to provide reinforcement of the previous training using the DVD, which will be distributed to retailers in markets that have previously received training (and a “take-away” for future training seminars), as well as continue the highly successful training to key retailers in at least 4 emerging markets in produce department layout design and produce handling. In countries where the training has been conducted, we will focus on expanding the program to new market regions and/or retailers. In addition to this, a professional DVD will be produced to provide reinforcement of the key training points, as well as a tool for reaching those unable to participate in the seminars. The DVD will be professionally produced, directed and edited, and use a combination of b-roll footage from participating organizations archives as well as a professional actor to act as a trainer. The DVD will use sub-titles in the languages of at least the top 10 export markets of the participating commodities in order to be a stand-alone training tool. In order to maintain continuity, as well as minimize cost, the DVD will need to condense the most important points/key topics into a viewer-friendly communications piece that we anticipate being 20-30 minutes in length (versus 3 ½ hours for the seminar plus the in-store practical training)

In countries where the retail training was previously conducted (China and India Sub-continent), the focus was on expanding the program to new market regions and/or retailers not previously reached. Workshops were conducted in four emerging markets:

China- Three workshops were conducted in China, with 154 participants attending from three different retail companies.

Russia- Five workshops were conducted, with 109 participants attending from six different retail groups.

India/Sri Lanka region - Five workshops were conducted, with 236 participants attending from fifteen different retail groups.

Vietnam - Six workshops were conducted, with 222 participants attending from eighteen different retail groups.

In order to reinforce the information in the training seminars, the grant also sponsored joint display contests (product availability permitting) for Washington apples, Northwest Pears, Northwest Cherries and Washington Potatoes at the retailers that participated. A summary of the results is below:

China – The contest was conducted in November 2010 and generated a total sales increase of 188%.

Russia – Unfortunately, contests could not be held in Russia due to lack of participation by the retailers. This is a new concept and was not one they were willing to implement due to store policies that discourage this type of activity.

India – The contest was held in March of 2012. The Contest generated over 38% average increase in sales among the participating retailers.

Vietnam – The contest was held in February and March of 2012. The Contest generated over 68% increase in sales.

In addition to this, a DVD was produced to provide reinforcement of the key training points, as well as a tool for reaching those unable to participate in the seminars. “*Getting the Most from Your Produce: A certification course on fresh produce handling & display*” was professionally produced, directed and edited, and uses a combination of b-roll footage from participating organizations archives as well as demonstration of the key concepts in an actual retail store environment. The key concepts included in the DVD are:

1. Introduction and Product Information (this includes information about the four participating commodities),
2. Health and Safety in Your Store
3. Managing for Quality of Product
4. Handling and Display
5. Promotions and Increasing Profitability
6. Customer Focus

The DVD uses sub-titles in the languages of the top 10 export markets of the participating commodities (English, Spanish, French, Arabic, Russian, Tamil (South India/Sri Lanka), Hindi, Malaysian, Formal Chinese (Taiwan), Simplified Chinese (HK/China), Indonesian, Thai and Vietnamese) in order to be a stand-alone training tool. In order to maintain continuity, as well as minimize cost, the DVD condenses the most important points/key topics into a viewer-friendly communications piece that is 20-30 minutes in length (versus 3 ½ hours for the seminar plus the in-store practical training).

In 2012, due to completion of the original work plan tasks under budget, an amendment to K737 was signed in August 2012 to create a web-based multi-lingual testing and certification website. WAC contracted to provide a website portal where the project target audience of retail produce department staff are able to a) view the video and b) take a certification test. Upon successful completion of the test, users have the opportunity to print out a certificate of completion. The contractor also provided site analytics to measure usage and provide feedback on country by country basis for follow-up. The site www.nwfreshproduce.com has been completed and translated into 11 languages: Spanish, French, Arabic, Russian, Hindi, Malay, Traditional Chinese, simplified Chinese, Indonesian, Thai and Vietnamese. We were unable to finalize an online format that would provide consistent results for Tamil and therefore dropped that language from the training.

The grant funds for this project only benefitted specialty crops.

GOALS AND OUTCOMES ACHIEVED

All tasks in the original work plan for were completed. Retail Training seminars were conducted in 2012, and a retail training DVD was planned, filmed and distributed to WAC representatives for use in their markets. Due to completing the original work plan tasks under budget, an amendment to K737 was signed in August 2012 to create a web-based multi-lingual testing and certification website. The site www.nwfreshproduce.com has been completed and translated into 11 languages: Spanish, French, Arabic, Russian, Hindi, Malay, Traditional Chinese, simplified Chinese, Indonesian, Thai and Vietnamese. The website has been launched, and WAC representatives are conducting outreach activities with the trade in their respective markets to familiarize them with the site.

Improved sales were not the only benefit of the workshops, although this was a key goal. For example, in China, retail display competitions, judged on key messages in the workshops, encouraged many creative displays, as well as achieving significant increases in sales. Six retailers reported increased sales by over 200% in the three months after the original workshops. In addition, they reported allocating between 10% and 15% more space to Washington apple displays, as well as reducing shrink by between 4% and 8%.

In India, a leading retailer reported increases in produce department sales of over 40% within days of the workshop, through advice on better merchandising and display during a post-workshop store visit.

In Sri Lanka, new relationships have been established by the WAC in-country representative with one of the major retail chains, as a result of the workshops, leading to requests for promotion activities and other support.

A feature of all the workshops has been the ability to customize the content for each participating retailer. This has been achieved through both pre- and post-workshop store visits, built around four-hour workshops.

In addition, workshop content has been developed from a retailer rather than supplier perspective, in consultation with the four commodity boards and the WAC in-country representatives.

Participating retailers in each country have also provided feedback on the workshops, resulting in additional information being included, such as how to improve customer service and manage shrink.

BENEFICIARIES

By the time Washington apples, Northwest Pears, Northwest Cherries and Washington Potatoes reach the retail shelves in foreign markets, they are high value items that, if mishandled, can cause significant losses to the store's produce department. This makes retailers hesitant to handle the product and in turn can mean limited opportunities through these important market sales channels for Washington apples, pears, cherries and potatoes. Therefore, this project has benefited all of the aforementioned from the involved Washington State commodities to the retailers with improved care and handling skills in order to increase their profitability.

Below is the most recent data we gathered from Google Analytics. 150 tests created and 91 were completed.

1. Tests taken and completed by country.

- China - 10 tests (7 completed)
- Costa Rica - 1 test (1 completed)
- Dominican Republic - 2 tests (1 completed)
- England - 3 tests (3 completed)
- India - 22 tests (15 completed)
- Lebanon - 1 test (1 completed)
- Mexico - 26 tests (22 completed)
- Malaysia - 2 tests (1 completed)
- Russia - 6 tests (5 completed)
- Saudi Arabia - 3 test (0 completed)
- Taiwan - 51 tests (30 completed)
- Thailand - 3 tests (1 completed)
- UAE - 4 tests (0 completed)
- USA - 5 tests (4 completed)
- UK - 1 test (1 completed)
- Vietnam - 1 test (1 completed)

2. 114 retailers registered have registered so far, but we don't know the actual retailer name. Following is a breakdown of the retailers that have registered by country:

- China - 12
- Costa Rica - 1
- Dominican Republic - 2
- England - 1
- India - 19
- Lebanon - 1
- Mexico - 18
- Malaysia - 1
- Russia - 5
- Saudi Arabia - 4
- Taiwan - 31
- Thailand - 2
- UAE - 6
- UK - 3
- USA - 9
- Vietnam - 1

The site was visited 330 times by 212 unique users. There were 2,949 page views for an average of 8.94 pages viewed per session. 61.5% of the visits were new users and 38.5% were returning visitors. The average user spent 1 minute, 42 seconds per page, which falls in line with the testing format.

61% of the visits were from the age group of 18-34. They were 54.1% male and 45.9% female.

The top 10 countries that most visited the site were:

Country	# visits	% new sessions	New Users	Pages/session
Taiwan	109	59.63%	65	10.74
India	43	74.42%	32	9.02
Saudi Arabia	38	76.32%	29	4.76
Mexico	36	50%	18	12.61
United States	30	76.67%	23	4.07
Russia	15	6.67%	1	18.60
United Arab Emirates	13	30.77%	4	7.23
China	13	61.54%	8	3.15
United Kingdom	13	69.23%	9	9.85
Malaysia	9	55.56%	5	6.11
Totals	330	61.5%	203	8.94

The site was accessed most often from a desktop computer: 238 (72.1%). It was accessed via a mobile phone or tablet 92 times (27.9%).

LESSONS LEARNED

Not only did we learn the importance of educating retailers about care and handling, we learned that they were excited to have this information. Having the benefit of receiving a Certificate of Completion, and a sense of accomplishment went far further than we ever expected.

John Baker suggested the best mix of participants involved produce staff, with the practical skills, senior managers, who could make decisions for change, HR/training managers, who could spread the information through their organizations, and marketing department staff, who learned how to effectively link products with promotions.

Importantly for products from the Pacific Northwest, the workshops highlighted the fact that price was not the only driver of sales.

For example, in almost every country where the workshops were held, Washington apples were in strong competition with much cheaper apples from China, other countries and local production, yet the market for Washington apples was strong and growing.

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PROJECT #4

Project Title: Chinese Brewery Education & Promotion of American Hops

Partner Organization: Hop Growers of America (HGA)

PROJECT SUMMARY

WSDA awarded \$120,913 in Specialty Crop Block Grant Program (SCBGP) funding to the Hop Growers of America (HGA) in October 2011 to support HGA's project entitled "Chinese Brewery Education & Promotion of American Hops." Work on this project ran from October 2011 to March 2013. The purpose of the project was 1) to gain a better understanding of hop usage in China; 2) to increase awareness of American hops among China's largest breweries, 3) to provide technical support to China's largest breweries, and 4) to increase the trial and purchase of American hops in China during the term of the project and beyond.

Chinese beer production has grown by over 100% in the last decade and is now more than double that of the U.S.—the world's second largest beer producing country. While China's relative slowdown in beer production growth in 2012 (just 2.5%) may have been inevitable given the dramatic rise of the last ten years, most industry observers expect growth to continue over the next decade given China's relatively low per capita beer consumption rate, which is half that of the U.S. and most countries in Europe. Even if growth continues to slow, China's immense beer production baseline translates into huge new volumes with just low single digit growth. Last year's 2.5% growth, for example, yielded 12.1 million new hectoliters of beer production, which accounted for 53% of the world's total net new production. China is truly the global engine for expanding beer production, which makes it a vital market for U.S. hop farmers.

At the outset of this project, most Chinese brewers lacked awareness of American hops, especially aroma varieties. Chinese breweries rely heavily on Chinese-grown hops, but have also started using more imported hops over the last decade due to rapid beer production growth. These imports, however, have become increasingly skewed toward European varieties from Germany and the Czech Republic. Europe's traditional influence on brewing in China has left a legacy in which Chinese brewers are often more familiar with—and have more experience using—European varieties. Indeed, many of China's largest breweries were originally established by Europeans in the early 20th century. According to Global Trade Atlas, the U.S. accounted for just 12% of all hops imported by China in 2011 and 2012. Germany and the Czech Republic accounted for a combined 87% market share. A major impetus for this project was that HGA believed that the U.S. should be able to capture a much larger share of China's imported hop needs, and that expanding that share would be important to ensure future growth and profitability for Washington's hop growers.

This project was timely given China's increasing reliance on imported hops in recent years. While Chinese-grown hops still account for the vast majority of hops used by China's breweries, Chinese hop farmers have not been able to keep up with brewery demand. Furthermore, as large multinational brewing groups continue to invest in China's brewing sector, Chinese breweries will increasingly seek to diversify their hop suppliers and have access to the quality and consistency that only the U.S. and Europe can offer. If European suppliers cement their existing relationships and role in the Chinese market, U.S. hop growers and exporters could lose the chance to increase their market share. It is with this background and motivation that HGA launched this project.

This project was not built on a previously funded SCBGP project.

PROJECT APPROACH

The project was officially launched in December 2011 and ended in March 2013. It was broken down into five phases: 1) building a team and conducting research; 2) developing marketing materials and leading a technical seminar on American hops; 3) meeting with individual breweries at their company headquarters and advising them on recipe formulation using American hops; 4) conducting co-brews with select breweries; and 5) surveying brewery and hop dealer contacts to measure the impact of the project's efforts.

HGA hired Bryant Christie Inc. (BCI) in December 2011 to manage the execution of the overall project, provide strategic guidance, and to travel to China to represent HGA. HGA also hired Dr. Patrick Ting and Yan Gao in February 2012 to round out its team for this effort. BCI was in charge of managing Dr. Ting and Mr. Gao, as well as reporting quarterly to the HGA board of directors on progress made during the project. Michael Schadler was the BCI lead on this project. Mr. Schadler has over six years of experience marketing hops internationally through other work BCI does on behalf of the hop industry.

Dr. Ting, who is originally from China, was the lead brewing consultant for HGA on this project. He retired from MillerCoors in January 2012 after working as a hop chemist in Wisconsin for 34 years. Dr. Ting was involved in all elements of the SCBGP project. He took the lead in content development for brewery presentations and marketing materials, and he was also the main speaker at HGA's September 2012 technical seminar in Beijing. Dr. Ting was instrumental in developing recipe formulations and providing technical advice to Chinese breweries during the project. He also provided HGA with legitimacy in China, as he is a world-renowned Mandarin-speaking hop scientist who is well known in Chinese brewing circles. Dr. Ting's reputation and connections opened doors in China for HGA that would have otherwise been hard to open.

HGA hired Yan Gao to be its on-the-ground representative in China. Mr. Gao is a pioneer of the Chinese craft beer movement. In 2008, Mr. Gao started the first craft/microbrewery in China – Oktoberfest Brewing Co. of Nanjing. He is also the author of the first craft brewing instruction book to be published in Chinese, titled "Get Your Own Brew!" Yan Gao and his staff were involved in all aspects of this project, including: 1) designing and printing HGA's marketing materials; 2) recruiting brewery participants for the seminar; 3) planning and executing all logistics of the seminar; 4) distributing hop and beer samples; 5) coordinating and leading the HGA visits to breweries; 6) participating in co-brews with the Yanjing and Tsingtao breweries; and 7) surveying breweries and hop dealers in China at the beginning and end of the project.

In February 2012, the team developed a preliminary list of Chinese brewers, hop merchants, and beer media that would be targeted throughout the year. A press release in Mandarin and English was then sent out to these contacts. Mr. Gao met with breweries and hop dealers in China to compile research and establish relationships. In April 2012, Dr. Ting traveled to Shanghai and Nanjing to meet with Yan Gao to discuss HGA's strategy and to begin brainstorming the Chinese educational materials. During the trip they also met with a number of breweries to discuss collaboration on the HGA project.

These preparations led up to a "USA Hops" technical seminar and beer tasting event hosted by HGA at the China Brew Expo in Beijing on September 19, 2012. Over 70 brewers and hop trade personnel attended the HGA seminar. Breweries represented in the audience included: Tsingtao, Yanjing, Zhujiang (Pearl River), Zhaoqing Blue Ribbon, Snow, AB InBev, and Asahi. Hop dealer companies included: Hopsteiner, Barth-Haas, Yakima Chief, Leebo Megahops, and Yumen Tuopu. Top officials from the China Alcoholic Drinks Association also attended, as did journalists from China Food Industry Magazine, China Central TV-7, Consumer's Daily, and Beijing TV.

The seminar began with an introduction from Ralph Bean, the director of the Agricultural Trade Office at the U.S. embassy in Beijing. Mr. Schadler then provided background as to HGA's role and objectives in China. The bulk of the presentation was given by Dr. Ting in his native Mandarin. The presentation provided an overview of the American hop industry—highlighting U.S. innovation, quality consistency, breeding efforts, and geographic diversity. The seminar then highlighted six American hop varieties: Cascade, Centennial, Chinook, Mt. Hood, Sterling and Willamette. Hop samples of these varieties were distributed to the seminar participants. Dr. Ting commands enormous respect in China and it was clear from the number of questions he received following his presentation that there is great interest in American hops in China.

The second half of the seminar was dedicated to a tasting of sample beers that were specially brewed for the seminar. The beers included:

- Mt. Hood Pilsner – brewed by Beijing Yanjing (China’s third largest brewery)
- Sterling Pilsner – brewed by Beijing Yanjing
- Willamette Pale Ale – brewed by Leon Mickelson (a New Zealand born brewmaster who runs “The Brew” in Shanghai)
- Cascade IPA – brewed by Leon Mickelson
- Cascade Pilsner – brewed by Yan Gao’s brewery
- Cascade/Willamete “Baby IPA” – brewed by Yan Gao’s brewery

Additionally, HGA (with the assistance of Gao, Ting, and BCI) developed a Mandarin-language marketing brochure for HGA, which was distributed at the seminar. This provided information on the six hop varieties highlighted in the seminar, as well as general information on the U.S. hop industry.

Following the seminar, HGA hosted a dinner for brewers and hop dealers at the Pass-by Bar and Restaurant in a historic district of Beijing. The Pass-by Bar is known for carrying imported craft beer from all over the world. It was a great venue for HGA’s objectives and a nice way to further build relationships with the Chinese industry.

In December 2012, Schadler and Ting returned to China to conduct more customized and intimate meetings with individual Chinese breweries at their respective company headquarters. The HGA delegation traveled to Beijing, Qingdao, and Shanghai to meet with the following breweries:

- Beijing Yanjing Brewery Co. Ltd. (Beijing)
- China Resources Snow Breweries (Beijing)
- Tsingtao Brewery Co. Ltd. (Qingdao)
- Jiangsu Dafuhao Breweries (Tongzhou, Jiangsu)
- Suntory Brewing Co. (Kunshan, Jiangsu)

The HGA group also met with Chinese representatives from Barth-Haas and Yakima Chief to gain a better understanding of Chinese market dynamics. Additionally, a meeting was held with Keith Schneller, the director of the USDA Agricultural Trade Office in Shanghai, to discuss HGA efforts in China and potential funding support from USDA. A full report on the meetings was delivered to the HGA board of directors and can be forwarded to WSDA upon request. Here below are a few highlights from the trip:

- Technical consultations and beer tastings with the Yanjing R&D team, which included Yanjing experimental beers and HGA pilot beers brewed by Yan Gao. Yan Gao presented a number of craft-style beers that might be suitable for the Chinese market. This included his “Baby IPA,” which is a less bitter version of an American IPA. It uses Cascade and Willamette hops. Yanjing has since signaled interest in using American hops to brew a craft-style beer for the Chinese market.
- Meeting and dinner with Tsingtao during which they indicated they’ve taken tangible steps toward developing craft-style brands using American hops. These developments have been influenced by the relationship HGA has built with Tsingtao over the last few years, which has included numerous Tsingtao decision makers attending the USA Hop Tour.
- Presenting the “USA Hops” logo idea to Tsingtao. As a future marketing initiative, HGA proposed the idea of placing the USA Hops logo on the bottle labels of any new Tsingtao beer that uses American hops. This idea still needs to be developed and vetted, but the Tsingtao representatives seemed quite interested. HGA’s rationale is that U.S. products have a good reputation among Chinese consumers and the USA Hops “brand” could provide a sales boost for a new beer launch.
- The president of Dafuhao stating that hops are the least expensive way to improve and distinguish beer, and welcoming ongoing HGA technical support to help develop new recipes using American hops. Dafuhao already

uses American hop extracts in some of its brands, which it advertises on its labels. This is proof that U.S. hops have appeal from a marketing and labeling perspective in China, which is exactly the pitch that was made to Tsingtao.

Following the week of meetings, HGA offered to collaborate with Tsingtao and Beijing Yanjing on an R&D co-brew. These two breweries showed the most interest in developing new beer styles based around American hops. In late December, Yan Gao returned to Beijing to brew a collaborative beer with Yanjing’s R&D Director and Chief Engineer, Lin Zhiping. Mr. Gao brought Willamette, Cascade, and Simcoe hop samples for the brews, which included an Irish Stout and a Belgian Double-style. Mr. Gao also led a full tasting session of all six of the beers brewed by his brewery—all of which use American hops. In February 2013, Mr. Gao traveled to Qingdao to conduct a co-brew with Linda Lin, Tsingtao’s Raw Material Lab Director. They brewed a batch of Yan Gao’s “Baby IPA” recipe, which uses Cascade and Willamette hops.

In March 2013, Yan Gao contacted China’s 20 largest breweries to conduct a survey on how each brewery’s hop usage had changed. HGA also contacted the three major global merchant hop companies that sell American hops in China to determine changes in brewery hop usage during the project period. Some breweries were not able to be reached, but of those that were contacted, the results are as follows:

Brewery	Contact	Current Usage of U.S. Hops	Increase in U.S. Hop Usage	Note
Beijing Yanjing	Lin Zhipin	None	Trials in process	Under Influence of HGA, the Yanjing R&D center is developing an IPA and Belgian-style craft beer, both of which use American hops
Yanjing Guilin Liquan	Liu Zhushui	10 MT of Apollo	First time use of Apollo in 2012	
Pabst Blue Ribbon China	Feng Zhaoneng	30 MT of Nugget, 30 MT of Cascade, Undisclosed amount of Apollo extract	30% increase in 2012 and 15% increase anticipated in 2013	Due to American influence of the Pabst brand, they are big users of American hops, but they are concerned about the high price of Cascade
Nanchang Asia Brewery	Shui Lizhen	None	None	They are currently in the process of being purchased by AB-InBev
China Resources Snow	Zhong Junhui and Yang Ming	10-20 MT of Cascade and Willamette	Overall usage didn’t increase, but purchased Cascade for the first time. Had previously used Willamette and Nugget	Was seeking additional Cascade in 2012, but the high price and lack of availability prohibited this purchase. They are averse to long-term contracting, which makes it

				difficult.
Jiangsu Dafuhao	Hu Jinchen and Li Dechao	200 KG of Cascade, 5 MT of alpha extracts	Used some American high-alpha extracts for the first time in 2012.	Trials in process with various aroma hop samples from HGA
Suntory China	Fan Xiuying	Some high-alpha extracts, but unable to disclose	No info	
Pearl River	Li Huiping	Approximately 1 MT of high-alpha U.S extract	Used some American high-alpha extracts for the first time in 2012	They would like to consider many U.S. varieties. HGA has sent various samples.
Tsingtao	Linda Lin	None	Trials in process, including Willamette, Cascade, Palisade, and Simcoe.	They are in the final stage of product development using Cascade and Willamette as substitutes for their current export beer recipes. They are also looking at these hops for new craft-style recipes.

The biggest success stories were with Beijing Yanjing and Tsingtao. Beijing Yanjing, the third largest brewery in China, is developing craft beer recipes using American hops for trial purposes. This is a big step for a macro brewery in China to invest resources in studying craft beer and unique American aroma hop varieties. Tsingtao—the second largest Chinese brewery and the sixth largest brewing company in the world—is now considering American hops to replace Czech Saaz and Chinese-grown hops in their current export beer. They are considering the Willamette and Cascade varieties, and have also requested trials for many other varieties. In addition to recipe changes to its export beer, Tsingtao is also considering the development of an IPA style craft beer, which would use American hops. With influence and collaboration from HGA, they have already brewed numerous trial batches.

The overall scope of the project did not benefit any commodities other than specialty crop.

GOALS AND OUTCOMES ACHIEVED

Outcome 1:

Goal: Increase usage of American hop varieties in China.

Target: By March 2013, at least 3 Chinese breweries out of the top 20 Chinese breweries will have contracted a U.S. aroma hop variety.

Benchmark: The aroma hop variety must be a variety that the brewery had previously never used.

Performance Measure: The three U.S. hop dealer companies that export to China will be surveyed at the end of the year, as well as each of the 20 breweries that are targeted by HGA.

Result: By taking the results from the survey above, and comparing to past hop usage surveys, HGA determined that two of the top 20 Chinese breweries purchased an American aroma variety for the first time over the last 15 months (January 2012 to March 2013). The two breweries were China Resources Snow and Jiangsu Dafuhao, which both purchased Cascade for the first time in 2012. As noted above, Tsingtao, Yanjing, and Dafuhao are also attempting to develop new recipes with American aroma hops.

Outcome 2:

Goal: Increase usage of American hop varieties in China.

Target: By March 2013, at least 3 Chinese breweries out of the top 20 Chinese breweries will have contracted a U.S.

alpha hop variety.

Benchmark: The alpha hop variety must be a variety that the brewery had previously never used.

Performance Measure: The three U.S. hop dealer companies that export to China will be surveyed at the end of the year, as well as each of the 20 breweries that are targeted by HGA.

Result: Comparing the recent survey results to previous hop usage surveys showed that three Chinese breweries began using American alpha varieties over the last 15 months that they had previously never used. These breweries include Guangzhou Zhujiang (Pearl River) Brewery, Yanjing Guilin Liquan, and Jiangsu Dafuhao. They each began using high alpha extracts from the U.S.

Outcome 3:

Goal: Increase usage of American hop varieties in China.

Target: At least 5 Chinese breweries from the top 20 Chinese breweries will increase purchases of American hops by 20% in 2012.

Benchmark: 2012 purchases by volume versus 2011 purchases by volume.

Performance Measure: The three U.S. hop dealer companies that export to China will be surveyed at the end of the year, as well as each of the 20 breweries that are targeted by HGA.

Result: The HGA surveys determined that four targeted Chinese breweries increased American hop usage by 20% in 2012. Three of those four breweries increased their U.S. hop usage based on purchasing high alpha extracts for the first time. The fourth brewery, Pabst Blue Ribbon China, increased American hop purchases by 30% in 2012, consisting mainly of Cascade and Nugget pellets.

The most positive impact of the HGA efforts will be longer-term in nature. As already discussed, Tsingtao and Yanjing are both in the process of testing U.S. aroma varieties for possible implementation. If these two breweries, which currently don't purchase any American hops, begin to implement U.S. varieties into their recipes, that success will be a direct outcome of the SCBGP-funded efforts, and the return on investment will be significant. Unfortunately, it is still too soon to verify if this will happen. Adopting new varieties for regular use is a long process for breweries—especially large breweries.

BENEFICIARIES

The Washington, Oregon, and Idaho hop industries will all benefit from increased American hop exports to China. Even those hop farms that do not grow hops for export markets will benefit from increasing overall demand of American varieties, which will help support prices paid by domestic breweries. The hop industry is global in nature and the U.S. industry typically exports around 70% of its crop. The main companies that export American hops to China are John I. Haas, Inc., S. S. Steiner, Inc., and Yakima Chief, Inc. John I. Haas is headquartered in Washington, DC, but its growing and processing operations are all in Yakima, WA. S. S. Steiner is based in New York, but its growing and processing facilities are also based in Yakima. Yakima Chief's headquarters and processing operations are in Sunnyside, WA. None of these companies have indicated any significant increase in their Chinese sales following the HGA efforts. This is mainly because the impact of the project will be longer term in nature. Prospects look promising with Tsingtao and Yanjing, which are both among the ten largest brewing companies in the world. If these two breweries begin implementing American hops into their recipes, the U.S. industry as a whole will see significant benefits.

LESSONS LEARNED

This project clearly illustrated that China's breweries are very interested in learning about American hop varieties and eager to conduct pilot beers with U.S. hops. Unfortunately, the timing of this project coincided with a difficult market environment in which to promote American hops in China. China's extraordinary beer production growth over the last decade has created new demand for imported hops, and it is expected that imports will continue to become a more important part of the Chinese hop market going forward. However, the hop market in China is still using up ample inventories of Chinese bittering hops that were significantly overproduced in 2008 and 2009. This makes U.S. bittering and high-alpha varieties less attractive to Chinese breweries given the cheap Chinese alternative. The HGA project, however, was mainly focused on increasing awareness of American aroma hops due to the unique attributes they impart in beer, and since most Chinese brewers have limited experience with these varieties. While the HGA efforts generated

great interest among Chinese brewers in U.S. aroma hops, these varieties have been in short supply over the last year due to the surge in craft beer production in the U.S. This, of course, has also driven up prices, which is difficult since Chinese breweries are very price sensitive when it comes to raw materials. Furthermore, the Chinese are reluctant to enter into long-term contracts, making it challenging to ensure supply meets demand.

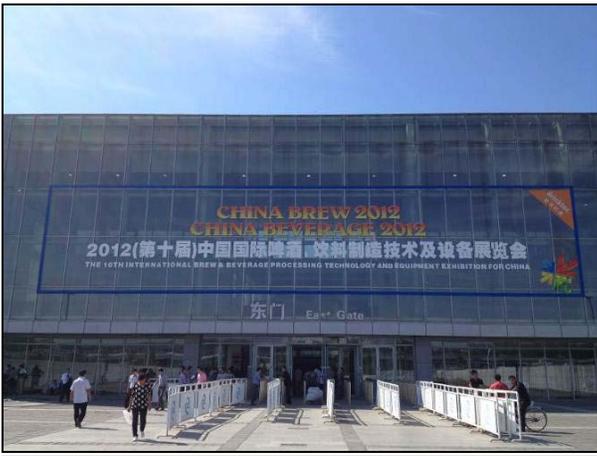
Despite these challenges, the Chinese market is not only growing by volume, it is also growing in sophistication. Brewery consolidation is continuing and more breweries are either being purchased by multinational breweries, or have become aligned with foreign brewing interests in some way. Chinese consumers, at least in the upper-income levels, are also becoming more sophisticated in the styles and beer brands that they drink. Premium and foreign brands have grown significantly in recent years. As these trends continue, Chinese breweries will look for ways to distinguish their beer tastes and showcase high quality ingredients. American hops can help Chinese breweries accomplish this. Perhaps the biggest challenge will be making sure that the U.S. industry has the capacity to fulfill the immense demand that could be created by a brewery like Tsingtao introducing an American aroma variety to its recipes.

While the SCBGP-funded project has helped make great progress in building awareness of American varieties, and may soon lead to large export increases, HGA does not have sufficient funding to continue its Chinese program for the remainder of the year. An industry referendum to increase bale assessments for funding of HGA's international promotional work will take place in the coming months. If it passes, HGA will be in a better position to restart its China efforts in 2014. In the meantime, HGA will maintain relationships with key Chinese breweries by inviting personnel from these breweries to attend the 2013 USA Hop Tour.

It is recommended that HGA continue its Chinese education and promotion efforts in 2014 if funding is increased. Although the oversupplied Chinese market has made it challenging to influence increased use of American hops in recent years, the China story is too compelling to ignore, and too much has already been accomplished by HGA over the last year to terminate these efforts. Indeed, interest in American hops is very high, even if that interest hasn't yet been translated into significant quantities of new sales. HGA has developed strong relationships with key decision makers at China's largest breweries, and they have started the process of trialing U.S. varieties and testing them in pilot brews. Two of the most prominent Chinese breweries have indicated that they are considering launching new beers that would be built around U.S. varieties, and HGA has set the groundwork for a marketing campaign that would allow the USA Hops logo to be used as incentive for bringing these new beers to market. If new funding is secured, these developments should be followed up on quickly starting in January 2014. Even if the initial success is modest, small purchases for a large Chinese brewery can equate to significant volumes given the scale of China's brewing sector, which accounts for 25% of the world's beer production. If the U.S. hop industry doesn't capitalize on the size and growth potential of China's beer production, its European competitors surely will.



Yan Gao (far left) and Patrick Ting (second from right) visit The Brew in Shanghai (April 2012)



China Brew Expo Entrance, Beijing (Sept 2012)



PATRICK TING PRESENTS AT THE USA HOPS SEMINAR AT CHINA BREW IN BEIJING (SEPTEMBER 2012)



MICHAEL SCHADLER PRESENTS AT THE USA HOPS SEMINAR AT CHINA BREW IN BEIJING; YAN GAO INTERPRETS (SEPTEMBER 2012)

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PROJECT #5

Project Title: Gras²p: Growers Response to Agricultural Safe & Sustainable Practices

Partner Organization: Washington State Horticultural Association (WSHA)

PROJECT SUMMARY

The GRAS2P program was created by the Washington State Horticultural Association to assist growers in attaining certification of their orchards under a range of audit schemes designed to insure ‘good agricultural practices’ (GAPs) are in place. GRAS2P was designed as an audit readiness program for growers of all sizes and the guidance manual created as a step-by-step approach to insure certification. With passage of the Food Safety Modernization Act and retailers requiring on orchard certification, the need increased dramatically.

Manual preparation/reproduction, training of specialists to teach growers and conduct pre-audits, the creation of training videos and teaching aids were a part of keeping Washington tree fruit growers competitive in the world marketplace by insuring adherence to food safety standards at the farm level.

Food safety was clearly on Congress’ mind when it passed the Food Safety Modernization Act on December 21, 2010. The new law aimed to ensure the U.S. food supply was safe by shifting the efforts of federal regulators to preventing contamination versus responding to it.

For the first time, FDA had a legislative mandate to require comprehensive, prevention-based controls across the food supply. This legislation transformed FDA’s approach to food safety, from a system that responded to outbreaks rather than prevented them. It did so, by requiring food facilities to evaluate the hazards in their operations, implement and monitor effective measures to prevent contamination, and have a plan in place to take any corrective actions that were necessary. It also required FDA to establish science-based standards for the safe production and harvesting of fruits and vegetables and to minimize the risk of serious illnesses or death. The ability to hold food companies accountable for preventing contamination was a significant milestone in the efforts to modernize the food safety system.

This project was timely due to the passage of the Food Safety Modernization Act (FSMA) with legislation mandating the need for fruit and vegetable producers to create and comply with a set of ‘good agricultural practices’ (GAPs). In addition, individual retailers were also setting dates, by which all, fruit/vegetable purchases must come from farms/orchards certified with Global Food Safety Initiative (GFSI) benchmarked audit schemes.

A 2009 Specialty Crop Block Grant provided funding for 450 pre-audits and built a strong foundation for the continuance of the GRAS2P grant. GRAS2P currently has over 500 growers enrolled with more to come in the following years. The 2009 GRAS2P grant preceded FSMA regulations and WSHA had anticipated the government would mandate stronger controls for an on-farm food safety program. Slowly, growers utilized the guidance manual to implement the audit scheme through which they obtained certification. Each year, WSHA anticipated grower participation to increase as more of the packing warehouses required their fruit to be certified in order to sell it at retail. This grant:

- Provided funding for an additional 423 pre-audits
- Provided funding to translate the guidance document into Spanish
- Covered printing and material costs for the preparation of 423 guidance manuals (workbooks)
- Updated the guidance manual to Global GAP version 4
- Conducted safety and hygiene training for 3,000 workers

As noted above, the Food Safety Modernization Act combined with retailer demands have made on-farm certification efforts a reality. Audit schemes – Global GAP, USDA GAP, Primus, (Safe Quality Foods) SQF, etc. – are among the variations available. The GRAS2P guidance manual affords users the ability to become Global GAP and/or USDA GAP certified.

Increased record keeping and training of orchard workers in safety practices was required for growers. An audit scheme – most likely Global GAP or SQF – was adopted and a guidance manual followed to insure all steps were implemented. Pre-audits and pre-auditors assessed readiness, for the actual audit, by insuring the grower was compliant so the actual audit cost could be kept down. Fruit with exposure to fewer biological hazards, made a safer product at the packing facility where GAP’s were in place to assure greater food safety. Marketers sold and shipped with more assurance the product was free from biological contaminants. Risk assessments were performed to determine the level of risk at both the orchard and warehouse level.

The grant allowed WSHA to conduct two large, safety and hygiene trainings to serve at least 3,000 workers. Upon completion of the training, workers received a GRAS2P certification card. The cards could be presented to orchards when seeking employment. Farm workers were often employed at multiple orchards throughout the year; each orchard they must attend safety and hygiene training. Therefore, a worker may watch the same safety and hygiene video multiple times in a season. Conducting mass trainings allowed 3,000 workers to receive the same high quality safety and hygiene training, while providing a certification card permitted those workers to present their card at new places of employment to indicate the training had been completed. This allowed for a much more efficient use of both the worker’s and the grower’s time, while still ensuring a safe food supply.

This grant was directed to insure that the guidance manual (created with grant funding), allowed the grower to implement a food safety program at the orchard level and helped the grower become compliant with the record keeping requirements so that his orchard passed a stringent audit. The pre-audit served to insure compliance and the grant saved the grower significant expense in moving toward legislative and retailer mandated food safety measures.

Growers and their warehouses were directly involved in either Global GAP or SQF certification: All on- farm employees and those entering farms/orchards were also impacted as growers moved toward greater awareness and record keeping of on-farm/orchard activities. Certifying Bodies (CB), such as NCSI, conducted the audits and issued certifications showing compliance; or they issued findings that required corrective action by the grower. Owners of audit schemes – Global GAP, SQF, etc. were involved, as were the CB’s doing the compliance audits. GRAS2P contracted with independent auditors trained, for the purpose to conduct readiness audits, in an effort to confirm adequate audit preparation by the grower.

PROJECT APPROACH

WSHA successfully met their yearly expected measureables by increasing the amount of growers who passed their pre-audits and certification. The compliance numbers increased each year of the grant with more growers wanting to be certified. From the start of this project, WSHA more than doubled the amount of acreage that became certified under GlobalGAP.

GRAS2P Participants	Apple Acres	Pear Acres	Cherry Acres	Total Acreage	
2014	4,872.50	1,529.75	2,133.86	8,536.11	
Warehouse A	1,465.29	1,014.63	684.93	3,164.85	
	272.35	2,207.75	151.00	2,631.10	
total 2014	6,610.14	4,752.13	2,969.79	14,332.06	2014
2013	3,694.60				

		1,409.70	1,867.00	6,971.30	
	453.85	2,782.55	292.00	3,528.40	
Total 2013	4,148.45	4,192.25	2,159.00	10,499.70	2013
2012	3,428.60	1,719.90	1,705.70	6,854.20	
	415.85	2,427.75	278.60	3,122.20	
total	3,844.45	4,147.65	1,984.30	9,976.40	2012
2011	2,439.50	1,517.60	850.80	4,807.90	
	221.50	1,667.80	111.30	2,000.60	
total	2,661.00	3,185.40	962.10	6,808.50	2011
Total	17,264.04	16,277.43	8,075.19	41,616.66	

The below is the percent increase of certified acreage by year.

2011-2012 = 46.53%

2012-2013 = 5.25%

2013-2014 = 36.50%

2011-2014 = 511.25%

The below is an excel spreadsheet depicting the number of audits each year per GRAS2P Warehouse.

	GRAS2P Pre-Audits + additional audits provided by warehouse				
	2011	2012	2013	2014	% Passed
K739 Grant					
McDougall	56	74	76	49	100
Blue Bird	70	142	143	147	100
Chelan Fruit	46	47	150	200	90
Blue Star	70	75	93	71	100
	242	321	462	467	
# of GRAS2P Audits			50	10	

WSHA did allocate extra pre-audit money to update the GRAS2P video (Fieldworker Orientation and Food Safety / Orientation para el Trabajador Agricola y Seguridad Alimenticia) to bring the content of the 2012 video in line with the current requirements of the Worker Protection Standards (WPS), and also with those standards set by the Washington

State Department of Labor and Industry and the Environmental Protection Agency (EPA) on relevant topics. The finished video would be used to serve growers and workers, not only in Washington State, but elsewhere in the United States. The video is bilingual and serve as a transfer and translation of knowledge, interventions, and technologies into highly effective prevention practices that WSHA disseminates to growers to learn and adopt into the workplace. This means a safer food supply to both our domestic and foreign consumers who can be assured of the safety of Washington tree fruits.

All project partners significantly contributed time and resources to train their own staff to complete required training and pre-audits. The GRAS2P video in collaboration with PNASH, AJL Productions, WSDA, North 40 and the Pacific Coast Cranberry Research Foundation collaborated to update the content of the 2012 video (Fieldworker Orientation and Food Safety / Orientation para el Trabajador Agrícola y Seguridad Alimenticia) in line with the current requirements of the Worker Protection Standards (WPS), and also with those standards set by the Washington State Department of Labor and Industry and the Environmental Protection Agency (EPA) on the relevant topics. The finished video would therefore be used to serve growers and workers not only in Washington State but also elsewhere in the United States. The video is bilingual and would serve as a transfer and translation of knowledge, interventions, and technologies into highly effective prevention practices that we want growers and fieldworkers to learn and adopt into the workplace. This instructional video translates to an educational tool that can be widely used throughout the United States to ensure a safer food supply to both our domestic and foreign consumers.

For WSHA, it was key to establish project partners that were bilingual to utilize their skills in multiple areas, such as, safety & hygiene training, manual translation and video interpretation. One of these key partners was Gustavo Montoya and Norma Gallegos with El Mundo Newspaper. Both helped with the video creation and translation. Gustavo also translated the GRAS2P guidance manual into Spanish for WSHA because the tree fruit industry employs such a large number of hispanic workers. In addition, WSHA staff managed the project and met frequently with GRAS2P warehouse participants, WSDA, L&I and other project partners to gather quantitative data, offer training, perform pre-audits and confirm compliance with the project goals and deliverables. Project partners and/or participants in the program other than WSHA included AJL Productions, McDougall and Sons, Chelan Fruit Cooperative, Blue Bird, Blue Star Growers, WSDA, L&I, Northwest Hort Council, Pacific Northwest Food Safety Committee, BSI Americas, Gustavo Montoya and Norma Gallegos.

The grant funds provided for this project would only benefit the specialty crop growers of the tree fruit industry. WSHA staff and warehouse personnel confirmed each GRAS2P participant who considered certification and the food safety training to ensure that all participants would benefit from specialty crop funding and to increase tree fruit competitiveness for the tree fruit industry.

GOALS AND OUTCOMES ACHIEVED

All expected Measurable Outcomes and performance goals were met for this project. The target of 423 grower pre-audits was accomplished. Each year, WSHA was able to track the acreage by commodity to monitor the increase of participants and/or tree fruit acreage joining the program and gaining GlobalGAP certification. WSHA hired a contractor to update the GRAS2P manual and translate it to Spanish. We successfully held two large food safety, health and hygiene workshops in Yakima and Wenatchee to train our pre-auditors, workers, and extension professionals associated with the tree fruit industry. Lastly, WSHA updated the GRAS2P video in collaboration with PNASH, AJL Productions, WSDA, North 40 and the Pacific Coast Cranberry Research Foundation to bring the content of the 2012 video (Fieldworker Orientation and Food Safety / Orientation para el Trabajador Agrícola y Seguridad Alimenticia) in line with the current requirements of the Worker Protection Standards (WPS), and also with those standards set by the Washington State Department of Labor and Industry and the Environmental Protection Agency (EPA) on the relevant topics. The finished video would therefore be used to serve growers and workers not only in Washington State but also elsewhere in the United States. The video is bilingual and would serve as a transfer and translation of knowledge, interventions, and technologies into highly effective prevention practices that we want growers and fieldworkers to learn and adopt into the workplace. This collaborated instructional video translates to a educational tool that can be widely used throughout the United States to ensure a safer food supply to both our domestic and foreign consumers.

The long term goal that is yet to be fully realized is to secure long term funding for all farmers to meet the required on-farm food safety requirements imposed by FSMA and retailers. With exception of securing long term funding for all farmers to meet mandatory on-farm food safety requirements, all activities and goals for the project have been met.

A total of 1,492 growers participated in the GRAS2P pre-audit program from 2011-2014. In 2009, WSHA started with zero growers that were certified increasing up to 66 growers that year. The overall percentage that passed was nearly a 100% completion rate. Those growers that had corrective actions, were able to fix the mistakes and gain compliance. All 423 pre-audits were provided through the GRAS2P program and many more were subsidized through the partnering warehouses. Each year, the program updated the GRAS2P manual as per GlobalGAP requirements and completed the English to Spanish translation. Please refer to the Project Approach section for actual data of tree fruit acreage and yearly pre-audits. All outcomes for WSHA project were achieved.

BENEFICIARIES

The growers, retailers and consumers have benefited from this project by maintaining a safe food supply. Consumers received fruits and vegetables that came from GAP certified production sites (as well as processing facilities) where every reasonable precaution was taken to exclude biological contaminants from entering the food chain. Outbreaks of food-borne illnesses and the resulting mandatory recalls damage consumer confidence. This results in fewer purchases, which is damaging to growers and processors. In short, everyone loses. If consumers renew their confidence in their food supply, that confidence will translate to buying decisions that result in the sale of more fruits and vegetables. This will benefit all on the production side of the food chain.

The economic impact of the tree fruit industry in Washington State is huge. Annually, the tree fruit industry contributes approximately \$2.5 billion in farmgate sales; \$6-8 billion in statewide economic activity; in excess of \$1 billion in direct employment wages and salaries; \$700-800 billion in export sales volume. Participation in programs like GRAS2P has led to on-orchard certification and will continue to lead to expanded sales of Washington tree fruits as the increased demand for certification becomes a requirement. USDA GAP is already required for shipment into US government procurement programs.

LESSONS LEARNED

The project allowed for the necessary and timely education and training of on-farm requirements that were required by the government and at retail. A negative result was that growers will continually have to pay each year for annual compliance audits for the mandated food-safety programs. WSHA will re-apply for more grant funds in 2015 to train growers on the new FSMA rules that will be released later that year. Rules and regulations by the government and retailers are always updating and changing and these grant funds have been vital to make sure the tree fruit industry remains competitive.

The GRAS2P video consists of 6 stand-alone modules. The modules include: Food Safety, Orchard Ladder Safety, Heat Related Illness, Lifting, Platform Safety and Pesticide Safety. Because of the pending changes with the EPA regarding their pesticide regulations, the Pesticide Safety module has been put on hold. Once the other five modules are in the polish editing phase of production, the status of this module will be reevaluated with the possibility of producing it with the existing regulations. The producer will consult with the WSDA, UW-PNASH and DOEH, and WSHA on this next month.

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ADDITIONAL INFORMATION

All funds from the grant and in-kind funds (\$54,157) were expended in paying for grower safety, health & hygiene training, on-farm pre-audits, updating the GRAS2P guidance manual and translating the manual from English to Spanish. WSHA provided grant administration services as in-kind and provided WSDA with quarterly and annual reports, billing and collection of grant funds and working with sub-contractors on training and pre-audits to insure grant compliance.

The website for GRAS2P can be found out: www.GRAS2P.com and WSHA: www.wahort.org

WSHA in collaboration with AJL Productions has created a video of 6 stand-alone modules of the bilingual (English/Spanish) video: *Fieldworker Orientation and Food Safety / Trabajador Agricola y Seguridad Alimentaria*.

- Once completed, the distribution and marketing of this video will be as follows: through WSHA, AJLProductions, LLC., Los Kitos and El Mundo Communications. A bilingual web page attached to AJL Productions, LLC website (www.ajlproductions.com) has been developed for this project, this includes the project description, the logos / names of those who contributed funds to the project and will link to their own web sites. Viewers can purchase the video as either a DVD or a download. The price for the DVD will be \$48.00+tax; the price for the down load has yet to be determined.

PROJECT #6

Project Title: Tracking the Organic Sector in Washington State

Partner Organization: Washington State University *Center for Sustaining Agriculture and Natural Resource* (WSU-CSANR)

PROJECT SUMMARY

The organic agriculture sector has been growing at a faster pace than most other agricultural sectors for the past decade or more. Washington State has seen similar rapid expansion, especially prior to 2009, with increased number of farms and acres being certified organic. A lack of current and detailed data on the organic sector has been identified by growers and businesses. Without sound information, it is more difficult to make good business decisions relative to organic production. The USDA National Agriculture Statistics Service does not regularly collect data on organic farming, but has done national surveys in 2008 and 2011. The Center for Sustaining Agriculture and Natural Resources (CSANR) at Washington State University has attempted to help fill this information void by gathering data on certified farms from certifiers, analyzing it, preparing reports, and making this information available to the public via presentation, publications, and the internet. No other entity has provided the level of detail that the CSANR work does. All of the work has been funded by grants, and additional funding was needed to continue with the annual reports. In addition, specific details on amount and value of production by individual crop, and estimated yields, have not been yet been developed. This project contained a major component that is providing initial estimates of these values. CSANR gets regular requests for information on the organic sector from growers, businesses, policymakers, agencies, and the media, and is seen as a key resource for current information on the organic sector in the state. The SCBG project enabled continuation of this role for an additional two years, as well as the development of new crop-specific information.

Businesses need current and detailed information in order to make informed decisions, including farms. Consumer purchases of organic food have risen annually for over 2 decades, and thus increased production on the farm is needed. Washington State is a national leader in organic farming, second only to California in total farmgate value of organic products (over \$280 million dollars for 2011, which was up 19% from the previous year). The state is the leading producer of organic apples, pears, cherries, sweet corn, some herbs, and hops. As farmers and businesses consider entry into the organic sector or maintenance or expansion of their current production, they need current detailed information on the production trends. Knowing how many acres of organic fruit there were in 2008 does not help a business decide whether converting a block of 'Honeycrisp' apples to organic status makes sense today. The data produced by CSANR does provide this help. The SCBG project enabled two more years of data collection, analysis, and dissemination, creating an unbroken annual record of the organic sector from 2004-2012. Trend data for organic apples in the state are now continuous since 1988. Data on the production volume and value for specific organic crops have been limited or non-existent, making it hard to evaluate their contribution to the state or local economy. Questions are continually raised about organic crop yields in relation to conventional yields, and ask whether organic systems are viable in light of increasing global food needs. The project enabled collection of detailed records on these issues for Washington State growers for the first time.

There has been previous work done by WSU but not funded by SCBCP. This grant enabled continuation of the annual data collection and dissemination as well as a new analysis of organic values, production, and yields.

PROJECT APPROACH

The project provided support for the collection, analysis, and dissemination of statistics on the Washington organic sector for years 2011 and 2012. The first round of data was gathered starting in November 2011, using preliminary data from WSDA to develop updates on organic tree fruit for industry meetings in December-February. Data on organic tree fruit price and volume was provided by industry organizations and was used in the tree fruit reports and presentations. By mid-December, all farm certifications were final and a final database output was obtained. Data were organized and cleaned, and then details by crop were developed and put into various presentation and report formats for end use. Additional data

were procured from Oregon Tilth Certified Organic, the other main certifier in the state, with a number of dairies. Organic livestock number estimates were made as well. Five different products were developed during 2012 and put on line at http://csanr.wsu.edu/pages/Organic_Statistics .

A simple survey of certified organic operations was developed to better understand their awareness of and use of the organic statistics being developed. This was sent out as a paper copy in the 2013 renewal packets, with copies returned to WSDA in January and forwarded to the project team. There was a 50% response rate from producers and a much lower response (18%) from other types of operations. 58% of grower respondents were aware of the organic statistics reports, with the larger farms in eastern Washington tending to be those that found direct benefit from the reports. 68% of those who were aware of the reports supported further funding of this work. A more detailed summary was submitted to WSDA.

Data were also gathered from a partner at FiBL in Switzerland to produce a paper on global trends in organic fruit that was presented at the 2nd International Organic Fruit Symposium in Leavenworth, WA. The paper has been published in *Acta Horticulturae*. An approach for gathering the sales and yield data was developed with WSDA and initial tests of the data were done. Based on those findings, it became apparent that additional work would be needed to deal with the large, complex, and irregular data set that would result. A proposal was developed with Dr. Mike Brady, WSU School of Economic Sciences, to work more extensively with the sales and yield data, and it was funded. The next cycle for the 2012 data started in late 2012, preparing preliminary data for both vegetable and tree fruit industry meetings. Three information products were developed and put on line. The focus shifted to continued data entry of the sales and yield data and its manipulation and analysis. A preliminary report of organic sales value, total production, estimated prices, and yields was written. This will be followed by a series of WSU extension fact sheets on specific crop groups, funded by another grant.

Certified organic acreage in the state peaked in 2009, and has declined each year since. While a “recession effect” was not unexpected, it is surprising that acreage has not grown, given the return to 9-10% annual growth in organic food sales. Forage crops and vegetables did show some acreage growth, while grains and tree fruit declined. The biggest growth was for organic blueberries, with new acreage in both western and eastern Washington. Despite a 13% decline in organic apple acreage from 2009 to 2012, shipments of organic apples from the state reached new highs, with Gala and Fuji the leading varieties, and Honeycrisp on a fast growth curve.

The number of organic dairy cows dropped steeply from 2009 to 2010, again due to the recession, and to high feed prices. The total herd size has increased slightly since then. Over 2 million organic broilers were produced in the state by 14 different operations. While overall certified farm numbers and acres have stabilized, farmgate sales have rose 19% from 2010 to 2011 to reach \$284.4 million, exceeding the previous peak in 2008. Sales decreased by 5% in western Washington and increased by 26% in eastern Washington, where sales accounted for 82% of all organic farmgate sales in the state.

The statistics developed by this project add to the historical record on the organic sector and point to its growing economic contributions despite a decline in number of farms and acres. Specialty crops are the main contributor to the economic impact of organic agriculture. This can be seen in the estimate that certified organic land accounts for an estimated 1.5% of the harvested cropland in the state, while certified organic sales account for an estimated 4.3% of the total farmgate sales in the state. Specialty crops tend to deliver higher total sales per acre. Based on the data collected, the FOB value for packed organic apples shipped from the state exceeded \$185 million in 2012. This type of information is important for growers and businesses determining whether to enter, expand, or exit organic production. It was also used to help justify research programs, and as part of the deliberations of the National Organic Standards Board on changes to the organic rules.

In the report entitled “Preliminary Data on Production Values for Select Organic Specialty Crops in Washington State”, examples of the results from the sales and yield data collection and analysis are presented. This work will continue with other funding support, including publishing a series of extension fact sheets on important organic crops or crop categories.

Total farmgate sales value of major organic specialty crop categories grew by 51% from 2009 to 2011, the last year for which complete data are available. An increase for 2012 was evident as well even with the partial data. WSDA reported total organic farmgate sales for 2011 at \$284.4 million. In that year, fruit and vegetable specialty crops accounted for an estimated 78% of the total organic farmgate sales in the state. This does not include the substantial amount of value added through fruit and vegetable packing and processing. In 2011, tree fruit, vegetables, and berries comprised 72%, 16%, and 9%, respectively, of the total sales of these specialty crops. Apple was the largest single crop (\$121 million, or nearly 54% of total organic fruit and vegetable sales value). Cherries (\$17 million) and pears (\$11 million) were the next largest tree fruit values. For vegetables, sweet corn had the top value at \$7 million, with potato, onion, green pea, and green bean all ranging between \$2-4 million. Blueberry was by far the leading organic berry at \$17 million and had already increased to \$23 million by 2012. All these crop categories accounted for 32,135 certified acres, or 35.7% of all certified acres in the state, yet generated 78% of the sales value, illustrating the economic contribution of these specialty crops. These and additional data will help to better characterize the organic sector in the state.

Based on the feedback from the user survey, and continued requests for the organic statistics information, it appears that the organic sector would benefit from the development of these data into the future. With budget cuts at the federal level, it is unlikely existing programs such as NASS or ERS will be able to perform this work. Both the level of detail and the yearly delivery have been important factors in making the WSU organic statistics unique and useful to end users. The organic agriculture sector in the state appears vibrant and growing, and providing it with good information similar to the rest of agriculture will remain important. Finding funding for this sort of on-going work is the challenge.

The key partner was the WSDA Organic Food Program. They provided the raw data for the annual statistical analysis each year. They provided preliminary data both years in order to meet deadlines for several grower meetings, then they followed this with a final version. They also provided raw data on production amount and sales value, which is the basis for the extensive analysis of these parameters that we have done. Oregon Tilth also provided annual data on acres and sales for the farms they certify in Washington State. Dr. Mike Brady, WSU School of Economic Sciences, secured funding that allowed for additional analysis of the production and sales value and has worked with the project team on various approaches that are currently being compared. The Wenatchee Valley Traffic Association and Washington Growers Clearinghouse provided data on organic tree fruit shipments and prices.

The project team understood that all organic crops are considered specialty crops. The focus of the work has been on fruits and vegetables which are specialty crops. Additional funding was used to include organic grains, beans, and forages in the annual reports in case they were not considered specialty crops. Funds from Dr. Brady will enable analysis of non-specialty crop data in the future after the specialty crops selected for this project are completed in terms of the production value and volume.

The project was designed to focus on organic fruits and vegetables, which it did. Tree fruit is the leading organic crop group in the state, and vegetables is second. These two crop groups were the focus of the project.

This project was designed to provide updated data on specialty crop production in Washington State to build on the existing multi-year data available for producers and companies involved with organic specialty crops. In addition, new data on specialty crop sales and yields (specifically for tree fruits, blueberries, sweet corn, peas, green beans, potatoes, and onions) were collected and analyzed. Totals of all crop acres and value needed to be tabulated in order to calculate the share of organic agriculture in the state that was attributed to specialty crops.

I estimate that the time spent on non-specialty crops was <5% of the research associate's time, based on nearly daily conversations, weekly updates, and the content of outputs. The research associate was budgeted for 0.50 FTE with SCBG funds, and an additional 0.16FTE with funds from other sources that varied over the grant period. Direct outreach to producers with findings from the project was with tree fruit and vegetable producers only. The budget statements were reviewed on a monthly basis and effort certification reports issued were verified with the correct accounts. No specialty crop funds were used for non-specialty crops.

GOALS AND OUTCOMES ACHIEVED

As described above, the activities involved collecting raw data on the organic sector, cleaning and analyzing it, and creating various reports and presentations that were shared with stakeholders and the public. This involved a lot of data entry, review of each line of data, manipulation in excel, and creation of final numbers that were used in various tables, graphs, and text. A survey was sent to all certified operations at WSDA to identify their awareness and use of the organic statistics. Data from the organic statistics website were collected to determine use through that venue. Presentations were made at 10 different industry and professional meetings to present the results to interested stakeholders.

There are no long term Expected Measurable Outcomes to work towards.

The project goal was to provide timely and detailed statistics to organic specialty crop producers, processors, marketers and other industry members to assist their decision making related to organic crop production area and marketing. This was achieved through the activities described above and the products made publicly available on line. In addition, preliminary data were produced to characterize total state production and value, yield, value per acre, and estimated prices for selected organic fruits and vegetables. Initially, the plan was to collect a single year of data from WSDA for this purpose. Due to the nature of the reporting by growers, it became obvious that this would not suffice, so the decision was made to enter data from five years of forms (submitted in 2009-2013) in order to capture four full years of data. This expanded the workload far beyond what the SCBG could support, and additional funding was found to conduct the work. The development of data for the selected crops for this proposal was completed, while additional computation and analysis will continue with the other funding to take advantage of the extensive information collected.

The baseline was set at zero, since the organic industry had not been previously queried on its use of the organic statistics over the past 7 years. A previous limited survey of organic fruit producers (n=62) found that the statistics helped 46% to make better business decisions, 18% to reduce risk, and 8% to improve profitability. The response rate from this survey for producers was 50%, and lower for handlers and processors. Of the responding producers, who were primarily crop producers, 58% said they were aware of the statistics reports. The awareness was 44% in western Washington and 59% in eastern Washington, and appeared to be related to the size of the business and how they market. Comments from some small direct market farms indicated that this work was not relevant to their situation. Regarding the usefulness of the reports, 36% of the responding producers said the information was useful, and this is less than the 50% of stakeholders targeted to use the information. If the sample could have been adjusted to remove the very small direct market growers for whom the statistics were not relevant to their business, then it is likely the 50% target would have been documented. Small direct market growers do not need to know price trends or acreage trends, as they tend to determine what to grow based on direct feedback from their customers, and their prices are independent from the larger “commodity” market system. Since about 35% of all certified farms are in the lowest sales bracket (<\$25,000 gross annual sales), this would leave about 65% of certified farms as more commercial operations, and this is close to the 58% of farms aware of the statistics.

For those growers finding the reports useful, specific responses for this question were as follows:

- 36% said they helped in planning what to grow
- 18% said they helped in planning how much to grow
- 17% said they improved profitability
- 27% said they reduced risk

86% of those growers reporting a benefit to their operation from the statistics were located in eastern Washington, reinforcing the finding that larger, more commercial growers (not direct market) were more likely to use and benefit from the statistics. The data above suggest that over 50% of the users are benefitting from the statistics, which meets the 50% target.

Another performance measure was the number of visits to the organic statistics website http://csanr.wsu.edu/pages/Organic_Statistics . The target was 1,000 visits per year. The organic statistics web page

received 1671 visits (1358 unique visits) and 3495 page views (2784 unique page views) in the first year, and 3078 page views (2622 unique page views) in the second year, exceeding the target. In addition, a goal of 25 unsolicited inquiries per year regarding the statistics via phone or email was set. This was achieved in both years (37 in year 1, 28 in year 2), and included contacts by media personnel whose stories then carried the results to a much larger audience.

BENEFICIARIES

Organic growers and businesses in the state and beyond have benefitted from the project, more so for growers who are large enough to sell into wholesale markets and commercial channels than the small, direct market growers. Several businesses, some in-state and some not, regularly inquire about the most recent statistics to help in their sourcing efforts for organic products from Washington State. Organic tree fruit growers, handlers, and marketers benefitted from the ability to demonstrate the importance and size of the organic tree fruit industry in the state to the National Organic Standards Board during its deliberations on the future use of antibiotics for fire blight control, a major disease concern. An additional two years of use were allowed in part because of the data presented. Organic sector advocates have benefitted from the results by being able to present fact-based information on the size of the organic sector and the trends over time, as part of policy discussions and in arguing for more support for research and education on organic farming. Over 2/3 of the survey respondents who were aware of the statistics supported continued funding so the work could be done annually. Several who were not aware stated that they would now look at them and expected to find them useful.

In addition, project personnel have met with USDA Risk Management Agency in Spokane to discuss future cooperation, as their programs are involving more organic growers. They have a need for yield and price information to help inform their payment schedules. The USDA Economic Research Service also used the data developed by the project as part of their national compilation of organic acreage.

The quantitative data regarding beneficiaries come from the survey that was conducted. The data indicate that about 60% of producers are aware of the statistics (close to the 65% of farms that are not in smallest sales category that are more likely to be direct market growers for whom the statistics are not useful in business decisions). About half of those using them were finding them beneficial, again skewed towards eastern Washington where more of the commercial scale organic farms are located. No data on direct economic impact were collected. However, if the availability of the statistical data helped growers improve business decisions or helped markets function better, then an economic benefit was likely achieved. For example, if the data have helped better match supply of organic apples with demand, and that has resulted in, for example, a \$0.10 per 40-lb box improvement in price (very small) compared to what they would have otherwise received, the aggregate benefit to the industry would have been \$650,000 for the 2012 crop (6.5 million boxes shipped x \$0.10). Companies that contacted the project team and were specifically using the data did not share what the economic impact of using the data were, but did indicate that they were helpful in them conducting their business, planning their production, and sourcing product.

LESSONS LEARNED

The challenges of working with the organic sales and yield data are reflective of industry wide awareness of the need for more harmonized and regular collection and dissemination of data on the organic sector. These and many other data are already reported by growers as part of the organic system plan, which goes to the certifying agent. However, few certifiers have the interest or capacity to “mine” these data and help better characterize the organic sector. The USDA-ERS still goes through certifier files by hand to try to produce national estimates for select organic crops. Washington State is fortunate to have one certifier (WSDA) that certifies over 90% of the farms, and enters some basic data for crops in a way that can be electronically manipulated and captured. There is on-going discussion within the organic industry of how improved data might be generated. But different players have different interests, and while theoretically possible to have all grower data flow to a certifier in electronic form using a standardized set of fields and units, this is currently unlikely due to financial constraints and philosophical differences. WSU has been fortunate to partner with WSDA for over 10 years on organic statistics. This has made Washington State one of the few to have regular, reliable data to help guide the expanding organic sector.

The broad lack of interest in the organic statistics by small scale direct market growers was not anticipated. However, a number of small scale farmers did comment that they were not aware of these statistics reports, that they would now look at them, and that this type of information was useful to keep them in touch with the trends in the organic sector in the state, of which they are part, and potentially directly or indirectly impacted even though they are not working in market channels where macro-level considerations of price and production potential drive their own farm decisions. A number of respondents in this group did state support for continued funding for the statistics.

The challenges of working with the sales and yield data were not fully appreciated. While project personnel did do some initial pre-testing, it was not fully adequate to anticipate some of the problems encountered and the magnitude of the data entry task. More exploration of the data prior to making a commitment to analyze it would have been helpful.

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ADDITIONAL INFORMATION

A portion of salary and benefits for David Granatstein were used as an in-kind match of \$15,443 from Washington State University. This was realized through the time he spent directing the project, working with project associates, fielding the survey, and presenting results at industry meetings. The WSDA Organic Food Program provided an unknown level of in-kind support by supplying database output for 2011 and 2012 years, and by scanning sales and yield forms to supply the data for that part of the project. The WSU BIOAg program provided over \$5,000 to support research associate time in additional data entry and manipulation of the expanded years of sales and yield data as part of a project funded through Dr. Mike Brady.

Reports produced with support from this project, available at http://csanr.wsu.edu/pages/Organic_Statistics

1. Kirby, E. and Granatstein, D. 2012. Trends in Washington State Organic Agriculture: 2004-2011 Data. Extension Fact Sheet FS082E, Washington State University, Pullman, WA. 5 pp.
2. Kirby, E. and Granatstein, D. 2012. Status of Organic Tree Fruit in Washington State. Extension Manual EM046E, Washington State University, Pullman, WA. 32 pp.
3. Kirby, E. and Granatstein, D. 2012. 2011 Current Status of Organic Agriculture in Washington State. On-line powerpoint presentation, WSU CSANR, Wenatchee, WA.
4. Kirby, E. and Granatstein, D. 2012. Organic Tree Fruit Trends 2011. On-line powerpoint presentation, WSU CSANR, Wenatchee, WA.
5. Kirby, E. and Granatstein, D. 2012. Washington State Certified Organic Acres and Sales (2005-2011 tables). On-line report, WSU CSANR, Wenatchee, WA.
6. Kirby, E. and Granatstein, D. 2013. Current status of certified organic agriculture in Washington State: 2012. On-line powerpoint presentation, WSU CSANR, Wenatchee, WA.
7. Kirby, E. and Granatstein, D. 2013. Recent Trends in Organic Tree Fruit: 201s. On-line powerpoint presentation, WSU CSANR, Wenatchee, WA.
8. Kirby, E. and Granatstein, D. 2013. **Certified organic acreage and sales in Washington State: 2012.** On-line report, WSU CSANR, Wenatchee, WA.

Additionally, a peer reviewed article was published:

Granatstein, D., Kirby, E., and Willer, H. 2013. Global area and trends of organic fruit production. Acta Hort. 1001:383-394.

This paper was presented at the 2nd International Organic Fruit Symposium and is available as a video stream at http://www.youtube.com/watch?v=XVDWPqCMnMY&list=PLE816E610DF986E58&index=36&feature=plpp_video

PROJECT #7

Project Title: Developing a Hard Cider Culture in Western Washington

Partner Organization: Northwest Agriculture Business Center (NABC)

PROJECT SUMMARY

Hard cider has a long history in the United States and Western Europe, and cider is one of the fastest growing segments of the U.S. liquor industry today. Cider varieties are distinct from “dessert” apples in that they have levels of tannins that enhance cider when fermented. Interest in commercial cider production is increasing locally, regionally and nationally. Research dealing with selection of best varieties, cider orchard management systems, quality cider production methods, and sensory evaluation of varietal ciders is needed to support the cider makers and cider orchard growers. A program of organized courses in hard cider production can provide beginning cider makers with the knowledge of correct techniques and practical hands-on experience, and help those already in business to improve the efficiency and profit for their operations.

Several regional cideries had been established in Washington and Oregon States before 2010. The Northwest Cider Association (www.nwcider.com), organized in 2010 with 8 member cideries, has grown to 36 members in Washington, Oregon, Montana, and British Columbia by November 2013. A great potential exists to create a Washington hard cider culture that rivals the wine culture of eastern Washington. In order to create such a culture, further research is being conducted to characterize hard cider varieties, and provide education on quality hard cider production in the region. This project builds upon the foundation of an emerging industry that can provide a significant revenue stream for Washington apple producers for years to come.

This project will lead to significant market expansion for cider apples and additional use of dessert apples and pears currently being produced. Value-added products represent the potential for a greater return per acre to farmers and enhanced economic sustainability of farmland. The demand for hard cider and perry is also creating a tremendous demand for apple and pear varieties used to produce craft hard cider and perry. This is resulting in the expansion of acreage of cider apples and perry pears and will continue to draw more orchardists into this sector. The impacts will be comparable to the explosive expansion of the Washington and Oregon wine industry that occurred in the 1980’s. The goal is to develop the Northwest as a premier hard cider region. Research and marketing support will result in increased sales volumes and higher prices for fruit growers and cider/perry makers. Production research will increase yields and reduce production costs for fruit growers. This will increase net profits for fruit growers.

Sales of hard cider in the United States have increased from 4 million gallons in 2004 to over 17 million gallons in 2012. Currently, cider/perry sales are only 0.5% of all beer sales in the U. S. If sales increase to 5% of the beer total, cider sales will increase to 310,000,000 gallons (cider consumption in the U.K. equals 18% of the beer total). This would require nearly 2 million tons of apples. Cider makers today include local and regional craft makers, as well as multiple multi-national beer brewers that have begun to pursue the U.S. hard cider market.

This project was not built on any previously funded SCBGP projects.

PROJECT APPROACH

Orchard based research, juice analyses, and evaluation and description of 8 varietal ciders made at Washington State University Mount Vernon Northwest Washington Research and Extension Center (WSU NWREC) were performed in 2011 and 2012. Productivity of 64 cider apple varieties in the WSU NWREC orchard was rated in September 2011 and October 2012. Fruit was harvested from all bearing varieties each year, and juice was analyzed for characteristics that impact cider making. In 2012, juice characteristics and harvest date of 4 cider apple varieties was compared at WSU NWREC and 4 commercial orchards located in central and western Washington. A mechanical harvest trial demonstrated that a raspberry harvester can successfully harvest cider apples. Mechanical harvest can provide significant savings in

labor time and costs without causing significant damage to the trees when compared with hand harvest. However, further work is needed to find a type of picker more suited to handle the larger size of apple fruit. Results of this study were presented at local and national workshops and conferences.

A total of 19 courses, workshops, and seminars were presented during the contract period. Presenters included the project partners, paid contractors, and guest speakers from the appropriate field of interest. There were 530 participants in these events. Participants were surveyed for feedback and appraisal. Copies of surveys are included as an appendix.

A. Northwest Agricultural Business Center (NABC) – provided staff and contractors for cider production classes, developing the cider production model, market research, education/outreach of results, and project oversight.

B. Washington State University Mount Vernon Research and Extension Center (WSU NWREC) provided research regarding the culture of cider apples, analysis of juice characteristics, evaluation of single varietal ciders by a trained panel of evaluators, and conducted a replicated field trial of mechanical fruit harvesting in 2011 and 2012.

Funds were used solely to enhance the development of hard cider using specialty crops: apple, pears, berries.

GOALS AND OUTCOMES ACHIEVED

Orchard-based research:

A replicated trial comparing the efficiency of machine harvest of cider apples with hand harvest was conducted on October 25, 2011 and October 17, 2012, at WSU Mount Vernon NWREC using a raspberry harvester (Littau Model OR0012, Stayton, OR). Results show that mechanical harvest of cider apples with this equipment can significantly reduce labor time and costs, but resulted in approximately 10% yield loss (fruit dropped on orchard floor and not recoverable). Damage to tree limbs and spurs of mechanically harvested trees was not significant. While major damage was caused to the fruit by mechanical harvest (fruit was cut and sliced), this did not affect juice quality when fruit was pressed immediately after harvest, nor did it increase the rot in stored fruit. Juice characteristics were not significantly different, except for higher oBrix in the fruit stored for two weeks, attributed to continued conversion of starches to sugar during the storage period. Results are shown in Tables 4-10.

Characterize juice and cider:

On September 20, 2011 and October 1, 2012, trees in the cider orchard at WSU NWREC were rated for productivity as follows: 5=heavy, all areas of tree fruiting; 4=good, most branches fruiting, commercial production level; 3= moderate, about 50% of branches fruiting, acceptable production level; 2=light, most branches not fruiting, unacceptable commercial; 1=poor, little or no fruit, unacceptable (unless alternate bearing variety in off year). The results are shown in Table 1.

In September and October of 2011 and 2012, a sample of 25 ripe fruit was collected from each fruit-bearing cider apple variety. Due to tendency for alternate bearing not all varieties produced fruit in both years, but data for at least one year were obtained for a total of 64 varieties. Both years, fruit were milled and pressed, then juice was frozen for analysis after the harvest season was over, in December–January of 2011 and 2012. Juice analysis was for characteristics that influence cider making, and results are shown in Table 2.

In October 2012, 1 box of fruit each from 4 different cider apple varieties were collected at four cooperator's orchards in western and central Washington (Port Townsend, San Juan Island, Tieton, and Wenatchee). Samples of one variety, Kingston Black, were not collected from Tieton. The juice was pressed at NWREC and frozen for analysis along with samples from the WSU NWREC orchard. Results are shown in Table 3.

Nine cider apple varieties were harvested for cider making in 2011 and bottled in spring 2012. They were evaluated in 3 sessions held in Wenatchee, WA (May 24, 2012), Port Townsend, WA (July 31, 2012) and Salem, OR (January 24, 2013), by a total of 19 panelists trained in sensory evaluation of hard cider. Results of the evaluation are shown in Table 11. Two cider apple varieties (Granniwinkle, Medaille D'Or) which have not yet been evaluated were harvested for cider making in 2012 and bottled in spring 2013 for future evaluation.

Market-based research:

The project team conducted market research and worked to develop a business model for cider production. A summary of this work was presented at the *Northwest Cider Seminar* held at Mount Vernon, Washington on December 15, 2012. A copy of the agenda and the market presentation made at the seminar are included in the appendix.

NABC conducted several surveys of cider makers and orchardists. Surveys included the following:

- Survey of cider makers about production and purchasing intentions (June 2012)
- Survey of cider makers regarding production volumes, estimated growth, and support of a future SCBG application (February 2013)
- Survey of cider makers about sourcing juice and apples, identifying cider apple and perry pear producers, and identifying distributors and distribution models (May 2013)

A summary of the results of each survey are included in the appendix.

WSU researchers with the assistance of other team members, cider makers, and orchardists are developing a cost estimation of establishing a cider apple orchard in western Washington. A summary of this work has been presented at several conferences and an extension publication is expected to be published in 2014. Figure 1 in the appendix is a summary that has been used for presenting this work.

Educate cider makers and orchardists:

A summary of the cider courses offered during the grant period:

2011 Cider Courses/Classes			
Principles & Practice of Cider Making	June 27 - July 1, 2011	20	No evals
Orchard Management	June 25, 2011	24	No evals
Orchard Management	December 10, 2011	23	No evals
Principles & Practice of Cider Making	Dec 12 - 16, 2011	24	Yes
2012 Cider Courses/Classes			
Principles & Practice of Cider Making	June 25 - 29, 2012	19	Yes
Orchard Management	June 23, 2012	22	No evals
Business of Making Hard Cider	June 30, 2012	22	No evals
Principles & Practice of Cider Making	July 23 - 27, 2012	26	Yes
Business of Growing Cider Apples	July 21, 2012	14	No evals
Orchard Management	July 28, 2012	25	No evals
Cider Seminar w/Peter Mitchell	December 15, 2012	90	No evals
Advanced Cider Making	Dec 10 - 14, 2012	20	Yes
2013 Cider Courses/Classes			
Business of Making Hard Cider	June 22, 2013	26	Yes
Orchard Management	July 13, 2013	35	Yes
Principles & Practice of Cider Making	July 8 - 12, 2013	23	Yes
Principles & Practice of Cider Making	July 15 - 19, 2013	25	Yes
Business of Making Hard Cider	October 26, 2013	35	Yes
Principles & Practice of Cider Making	Dec 2 - 6, 2013	25	Pending
Orchard Management	December 7, 2013	32	Yes
	Total	530	

A total of 19 courses, workshops, and seminars were held during the project period serving a total of 530 persons. Two new workshops were added – one on the business of making cider and one on the business of cider apple production. Presenters for the workshops have included experienced industry professionals and qualified faculty and staff from Washington State University. We have been fortunate to have Peter Mitchell provide instruction for the Cider & Perry Academy, and offer certification from the Nation Association of Cider Makers (United Kingdom).

Participants were surveyed during the contract period. Results have been very favorable. The project team has worked to improve the quality of the education based on survey results. Copies of course survey have been provided.

Continuation of orchard-based research is expected to have long term outcomes as a new replicated research cider apple orchard will enable research in improved methods of mechanical harvest and mechanical pruning to reduce labor costs and increase orchard profitability.

Continuation of the production model will also have long-term impact. Cider orchards continue to be planted, and the project team will continue to work for cooperative grower efforts.

Activities and Goals	Accomplishments
Perform variety evaluations	Productivity rating performed of 64 cider apple varieties at WSU NWREC Juice analysis performed for 64 cider apple varieties at WSU NWREC Comparison of juice analysis for 4 commonly grown cider varieties from WSU NWREC and 4 cider orchards in western and central WA 9 varietal ciders made in 2011 and evaluated by a sensory panel in 2012
Conduct research on mechanical harvesting	Replicated trial at WSU NWREC comparing efficiency of mechanical harvest with hand harvest performed in 2011 and 2012
Conduct Market Research	Industry surveys completed to characterize current production and future goals Production and sales data collected Production cost study initiated and near completion (new funding received) Planned acreage for new plantings of cider apples exceed 100 acres
Educate cider makers & Orchardists	19 courses, workshops, and seminars offered 530 paid participants NWCA membership increased from 8cider makers to 36 cider makers
Present data and findings to grower interest groups	December 15, 2012 – Cider Seminar, Mount Vernon, WA with cider makers, researchers, growers, and marketers; 85 participants February 7, 2013 – CiderCon National Cider Conference, Chicago, IL; 240 participants, presentations: Survey of cider makers and cider apple growers (G. Peck, C. Miles, O. Padilla-Zakour, and N. Rothwell) Information presented at the 19 courses, workshops, and seminars. Analysis of single variety ciders in western WA State (C. Miles) Mechanical harvest opportunities for hard cider apple orchards (C. Miles) Information available at web sites: http://www.agbizcenter.org/business-services/classes-and-workshops/all-things-cider – www.nwcider.com - http://extension.wsu.edu/maritimefruit/Pages/Cider.aspx

Progress was made on the goal of increasing production of cider apples and perry pears. The specific goal of 30 producers adopting a specific business plan was not met. However, surveys indicate that new acreage will exceed the goal of 100 acres. The project team will continue to work to develop a cooperative grower effort to produce and market juice for cider and perry. It is apparent that this effort will continue for much longer than the grant period. Because orchards require 5-7 years to establish, processing and marketing efforts will ramp up when increased production creates a demand for these developments. In the meantime, the demand for cider apples and perry pears have created a situation there is an instant market for the available fruit. (Outcome 3)

The target for education was to offer 5 courses to reach 80 participants. 19 courses, workshops, and seminars were offered that reached 530 participants. Participant surveys were used to evaluate results. (Outcome 4)

BENEFICIARIES

The completion of this project benefits cider makers and growers of cider apples in providing juice analysis of 64 varieties of cider apples, and the sensory description of finished varietal ciders. This information will help growers decide on the varieties to plant that will best suit their locations and types of cider they are making. Information on the sensory description of ciders also benefits those who are just becoming familiar with marketing and promoting ciders to the public, in that it gives them a descriptive vocabulary based on evaluations by expert cider taste panels. Information on mechanical harvest with data on potential savings in labor time and costs will help growers be more economically profitable.

NABC is helping to manage and grow the Northwest Cider Association, a trade organization formed by cider and perry producers throughout the Pacific Northwest to promote awareness of regional artisanal cider and perry. Already recognized as an international leader for our abundant apple growing regions, the Northwest is becoming known for the cider apple research at Washington State University and professional cider workshop series managed by NABC. The workshops were launched under the leadership of WSU and feature renowned cider expert Peter Mitchell from the UK. In addition to seminars, workshops and educational events for both cider makers and apple growers, NABC is developing a framework to help manage the industry's explosive growth and help to establish a Northwest cider culture.

The NWCA has increased membership from 8 cider maker members to 36 cider maker members during the project. 530 participants participated in educational opportunities. Planting intentions exceed 100 acres for 2014.

LESSONS LEARNED

Project staff working on the mechanical harvest trial gained a fuller knowledge of the factors involved in effective machine harvest and new options to investigate in future trials. NABC staff members have participated in courses and have developed skills related to the production and marketing of cider and perry. All team members have been effective in being a part of the development of the re-emerging the cider industry in the northwest. We underestimated the length of time required to implement the business and production model for orchardists. Because orchards require 5-7 years to become fully established, a longer period of time will be required to implement the anticipated business models.

Project goals were successfully achieved.

CONTACT PERSON

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david@agbizcenter.org

ADDITIONAL INFORMATION – See Attachment C 12-25-B-1262 Cider

Salaries:	\$ 46,243.98
Benefits:	3,909.47
Travel:	2,897.84
Supplies:	36,098.96
Contract staffing:	35,939.00
Other contractual:	<u>38,031.08</u>
Total	\$163,120.33

Matching funds were sourced through local matching funds including fees for courses and workshops. Funds were used to fund additional courses, workshops, and project activities.

Material was added to the WSU NWREC cider web page:

<http://extension.wsu.edu/maritimefruit/Pages/Cider.aspx> , including links to other cider research programs (Virginia Tech, Cornell, Michigan State University), cider associations and groups, publications and factsheets, and a video of the 2011 mechanical harvest trial <http://www.youtube.com/watch?v=hCEjbuML5GA> titled “Machine Harvesting Cider Apples” (J. Roozen, J. King, and C. Miles) NABC created a new web page::

<http://www.agbizcenter.org/business-services/classes-and-workshops/all-things-cider>

Photos of mechanical harvesting are included in the web page.

The appendix includes the following:

- Juice evaluation data
- Mechanical harvest data
- Course/workshop evaluations
- *Northwest Cider Seminar* information
- Survey results
- NWCA member list

PROJECT #8

Project Title: Bridging the Gaps: Opening GAP/GHP Education for Farmers and Auditors

Partner Organization: WSDA Fruit & Vegetable Inspection and Food Safety & Consumer Services Programs (WSDA)

PROJECT SUMMARY

Washington's small, mid-sized, and diversified specialty crop farms face unique challenges related to developing and implementing food safety plans whether for a 3rd party audit or simply for on-farm risk management because they are often run by a single family with few or no employees. While their operations tend to be simple, they may not have space for designated packing structures or produce cleaning systems, and they are frequently less experienced with the kind of documentation required to meet a GAP audit standard. As more buyers require or prefer GAP/GHP certification for growers and processors entering or expanding markets such as schools, hospitals and grocery stores, small operators face increasing pressure to become GAP/GHP certified. GAP/GHP certification requires a set of standard operating procedures (SOPs) that explain the operation's food safety plan in detail, and address a detailed set of risks and potential risks for microbial contamination of the product. This can be intimidating and relatively costly for small, mid-sized, and diversified specialty crop producers. Bridging the Gaps serves to lower the barrier to Gaps for producers by demystifying the procedural side and sharing low-cost ways to meet the GAP standard. The project also educates GAP auditors about common practices and concerns of growers on smaller, diversified farms, and facilitates direct interaction between growers and auditors to foster better understanding and trust, and to increase the number of smaller farms seeking and succeeding in GAP audits. This project was designed to provide friendly on-farm training for farms and auditors and to develop tools and resources to assist them as they seek to improve food safety on their farms, plan for GAP/GHP audits, and prepare for the upcoming FDA Produce Safety Rules.

Statewide, grower feedback has consistently demonstrated significant and growing anxiety about how to properly plan for the current and upcoming market and regulatory requirements resulting from marketplace preferences for GAP certification, as well as the proposed Produce Safety Rule in the Food Safety Modernization Act. Buyers, consumers, and in time, regulators, want verification that growers have measures in place to minimize the risk of microbial contamination of their products. This presents challenges to specialty crop growers, especially those with limited resources and staff time. 'Bridging the Gaps' included grower education and resource development, but it was also essential to enlist auditors in finding scale-appropriate solutions to food safety challenges. This professional development helped WSDA GAP auditors better understand and adapt their approaches to the different kinds of issues that small, mid-sized, and diversified specialty crop farms face. By making the planning and audit process more accessible to growers, and helping auditors better understand these farm operations, a barrier to entry has been reduced for these growers.

This project built on a previous SCBG-funded Farm to School project, which concluded in September 2012. That project brought together school nutrition professionals and farmers for WSDA-led workshops, conferences, kitchen skills trainings, and on-farm events, including two which were focused on Good Agricultural Practices. During these education and outreach events, farmers consistently expressed concerns about providing the safest product possible to institutional and other markets. While food safety itself, and the freshness and safety of their product was the most important focus for growers and school nutrition professionals alike, 3rd party food safety audits continued to be discussed regularly. Conversations and question/answer sessions revealed some stark gaps in knowledge across the range of 3rd party food safety certifications, and in particular the USDA GAP/GHP audit. WSDA could see that bridging that gap would facilitate better market access for growers, and a greater understanding of food safety practices and audits for buyers. Through participation in this previous project, the WSDA GAP audit staff also recognized that as small, diversified farms began to be interested in the larger markets that were requiring 3rd party audits, they would need to learn more about how these farms operate in order to review their food safety practices knowledgeably.

During the Farm to School Specialty Crop Block Grant project (2009-2012), WSDA conducted two on-farm trainings in partnership with the WSU Small Farms Team and Tilth Producers of Washington. Participants walked through the farms

as host farmers discussed their food safety planning and GAP auditors shared assessment practices. Based on the walk through with the GAPs check list in hand, the groups discussed possible first steps to take and things to consider. Participants were able to view practices that were already in place, and start thinking of what practices make sense to integrate based on individual farms' practices. Grower interest was strong, and WSDA educators recognized that the upcoming FDA produce safety rule process meant growers needed even more support to prepare and plan for improved food safety planning and documentation on their farms. This current grant was written during that time, to ensure that WSDA would be able to meet this demand with reliable information.

During that initial project, WSDA developed a video on Good Agricultural Practices to broaden the reach of GAPs training and information. The video features, farmers, auditors and food buyers addressing food safety and Good Agricultural Practices, and is designed to introduce WSDA's collaborative approach to working with growers, partners and auditors to find feasible food safety solutions. The video has received 1,691 views, and is used by agricultural educators in workshops and classes on food safety. The video is featured on the [WSDA Bridging the Gaps page](#), the [WSDA Farm to School Toolkit](#), and the [WSDA YouTube page](#), and has been used in trainings for WSDA GAP/GHP auditors in early promotion of this Bridging the GAPs project.

PROJECT APPROACH

Project Activity	Amended	Completed
Assemble GAPs Team		Oct 2011
GAPs Team Meetings	WSDA Education and Outreach staff met regularly with WSDA GAP/GHP audit staff to plan events, strategize the project, and write and edit the manual. WSDA GAP/GHP IT representative worked closely with Education and Outreach staff to develop web-based resources, such as the initial contact listing and email links, the online Q&A, and the web-based audit request wizard, and to update web information.	Throughout project
Conduct On-Farm Auditor Training	Four 2-day trainings were provided to auditors, with a classroom component and attendance at on-farm pre-audit grower assessment events. Auditors attended 3 additional pre-audit grower assessment events (without a classroom component) to provide them with insight and experience on diverse farms. (Four 2-day or eight 1-day trainings were originally scheduled.) Auditors also received Bridging the GAPs training at their annual refresher course meetings.	August 2014
Conduct On-Farm Grower Pre-Audit Assessments	7 pre-audit grower assessments were completed in different regions of the state. (Four were originally planned) WSDA also conducted 2 roundtable events for growers and auditors in regions of the state where host farms could not be found for on-farm events.	June 2014
Contribute Feedback and Comments to National Level Food Safety Discussions	Ongoing. WSDA used this project to share information and encourage growers to provide comments during FSMA comment period, and to gather questions and feedback from growers to inform WSDA's comments. WSDA staff attending national meetings and local listening sessions shared questions and concerns from growers throughout the project.	Sept 2014
Develop GAP/GHP Training manual for small to mid-size specialty crop growers and	Spanish and English versions, in hard copy binders with flash drive templates and documents, and online version with interactive Table of Contents and live links	Sept 2014

processors		
Design and conduct surveys for sales impact and customer service	Adapted WSDA farm survey to include GAP questions (conducted Spring 2014), and surveyed project participants at and after events (throughout project)	June 2014
Develop online wizard for GAP/GHP	Part 1: Info webpage and Q&A for farmers on GAP/GHP standards and audit process Part 2: Online audit request form	June 2012 Sept 2014
Post training manual online		Sep 2014

Project Activity Descriptions:

- Pre-audit grower assessments for small, mid-sized, and diversified specialty crop farms provided opportunities for host farms to receive auditor feedback on their food safety practices, and to serve as leaders and examples in their region, as they invited farm peers and auditors to their farm to learn more about on-farm food safety. At each event, growers and auditors walked the farm, discussed key issues with WSDA educators, and learned ways that farms of that type, scale and region could meet the GAP standards in cost-effective ways. WSDA educators and auditors were able to share real-life examples of worker sanitation facilities, hand wash stations, harvest and field packing practices, compost systems, and produce washing and storage areas, allowing them to discuss with growers the food safety implications of the various models, along with ways growers can cost-effectively adapt practices to improve food safety on their farms. These events also served as a forum for WSDA to share information and updates on FSMA implementation, Washington State Food Code provisions that affect small farms, and to discuss market demand and reasons for food safety planning and certification. Two of the pre-audit grower events were provided with Spanish-language interpreters, and with particular attention to demonstration as a teaching method, in order to better reach Latino growers. At both events, a bilingual GAP/GHP auditor was in attendance to answer questions and clarify GAP standards. The Yakima event was presented with WSU Small Farms Team partners who provided assistance with planning, farmer recruitment, materials translation (including a Spanish language food safety glossary), and on-site interpretation. The Viva Farms event in Mt. Vernon was a partnership with Viva Farms, and reached both a Spanish and an English-speaking audience. This event was presented in conjunction with an RMA-funded Wholesale Success training which was held on the following day.
 - 7 pre-audit grower assessments were completed in regions spanning the state
 - 189 farmers and other constituents participated
 - 40 auditors participated



WSDA GAP/GHP auditors discussing and learning about outdoor packing areas at Skagit Flats Farm.



WSDA Educator and GAP/GHP auditor teaching field-side at Pheasant Fields Farm.

Farms responded well and joined in with their questions, concerns and plans for food safety planning and implementation. Host farmer Nikki Johanson sent the following thank you by email to the project coordinator:

I want you to know how much I and a lot of others appreciated you coming to Kitsap. Look out, it's just the beginning. We will call on you again for help as we write those policies, etc. The training here has created all kinds of dialog and a ripple effect. And there's a new conversation about it every week. It is a pleasure for me to write about and talk about the very positive things your team is doing for small farmers in WA (and, I'm good at talking). You know I was a bit apprehensive having you come HERE, but it's the best thing I've ever done for Kitsap farms and farmers.

- Producers' Roundtables gathered growers, auditors, educators and buyers to discuss market and regulatory requirements for food safety, with a focus on better understanding the constraints and opportunities associated with each of the different participants' businesses. The Spokane Roundtable also provided three different types of buyers an opportunity to share why food safety certifications are useful to them, and what they expect from growers in relation to on-farm food safety.
 - Producers' Roundtable on GAPs in Moses Lake October 28, 2013
 - Producers' Roundtable on GAPs in Spokane May 7, 2014
 - 44 farmers, processors, buyers, and advocates attended
 - 2 auditors participated

The roundtable model was adopted during Year 2 of the three year project because there had been a shortage of farms willing to host on-farm events in some parts of the state. As a result WSDA held roundtable meetings in place of on-farm events in areas not served by on-farm events. As growers became more familiar with the project, WSDA found that farmers preferred on-farm events and more growers stepped forward to host. Therefore, only two roundtable events were held, and others were able to be provided as growers appear to prefer—on-farms.

The following quote came from one Producers' Roundtable participant, whose farm's market-participation was subsequently featured in a local news story:

Hello,

Jackson Farm was featured on KREM today. Here is a link to the story.

<http://www.krem.com/longform/news/local/good-news/2014/10/10/jackson-farms-offer-fresh-school-lunches/17058517/>

This all came together starting with the meeting (Roundtable) in Spokane in March, so thank you for all of your efforts at the state level.

Dan

- GAP/GHP Auditor professional development and partnership
 - In total WSDA GAP auditors participated in one or more components of this project 109 times (some auditors came to multiple events), whether that was by attending trainings, joining a farm-walk, or speaking at an event. Some auditors participated in several different kinds of activities. Auditor trainings provided auditors with opportunities to see practices on small, diversified farms in different regions of the state, including rustic outdoor packing areas, common storage and transport practices, and basic documentation systems, and discuss simple, cost-effective ways these growers can meet the GAP/GHP standards within their constraints of cost, staffing, and space. Auditors were also able to see and discuss a variety of place-specific food safety issues such as flooding and over-wintering birds. Auditor trainings were designed as two-session events, most with a first session on Day 1 with a WSDA educator leading a presentation and discussion about the specific agriculture, climate, markets and food safety challenges for the specific geographic region, and Day 2 tied to an on-farm grower/auditor education event. This allowed WSDA to provide on-farm education to more growers and auditors in more areas of the state (rather than having some host auditors only and others host only growers). This evolution occurred because the farm host of the first auditor training asked if he could invite other area farmers, and WSDA found that the cross-pollination and discussion increased learning and trust-building for all participants.
 - WSDA presented on Bridging the GAPs at annual WSDA GAP/GHP auditor refresher courses each year of the project.

- Year One: WSDA Education and Outreach staff introduced the project, discussed grower types, regional food safety issues (like flood plains and wintering geese), and language that works when talking about food safety with small-scale diversified growers. The language section provided excellent conversation about how different types of farmers think and talk about “commodities” vs. “crops” or “food,” “farms” vs. “operations,” etc., and worked to encourage auditors to use plain language when out in the field, as a way of translating the audit language to farmer practice and style.
- Year Two: WSDA Education and Outreach staff discussed the FSMA comment process and upcoming implementation, including potential impacts on farms being served by this project. The group also provided an update on the Bridging the GAPs project and discussed Bridging the GAPs resources for them to share with growers: the project website, online Q&A, Spanish language audit checklist. WSDA staff discussed other food safety topics that affect growers, including the 2009 FDA food code fact sheet and a state-level cut leafy greens fact sheet, so that auditors would be able to knowledgeably discuss related topics that might come up in farm audits.
- Year Three: WSDA Education and Outreach staff shared updates on Bridging the GAPs project end stages and introduced the Bridging the GAPs Farm Guide, encouraging them to use the guide as a resource and direct farms with pre-audit inquiries to the guide. The group also discussed Harmonized GAP standards and new developments in water testing expectations.
- Four auditors were featured in educational/technical assistance videos, available in English and Spanish
- Three auditors contributed significantly to the development of the Bridging the GAPs Farm Guide, as well as the online Q & A

Summary of Auditor Trainings, Grower Pre-audit Assessments, and Producers’ Roundtables

May-14	Event/Workshop	Auditors	Farmers & others
Imperial's Garden	Grower pre-audit assessment	9	9
Yakima F & V Office	Auditor Training	11	
Williams Hudson Bay Farm	Grower pre-audit assessment	6	6
Pasco F & V Office	Auditor Training	10	
Spokane region	Producers Roundtable on Food Safety	1	40
Mar-14			
Cultivating Success	On-farm food safety workshop	1	24
<i>Snohomish/Pierce County</i>			
Dec-13			
Viva Farms	Grower pre-audit assessment	2	40
Oct-13			
Alvarez Farms	Grower pre-audit assessment	2	8
Oct-13			
Moses Lake	Producers' Roundtable on Food Safety	1	3
May-13			
Local Roots	Grower Pre-audit assessment	8	19
	Auditor Training	8	

Apr-13			
Pheasant Fields	Grower pre-audit assessment	4	30
Aug-13			
GAP Auditor Refresher	Project introduction; Q & A	15	
Aug-12			
GAP Auditor Refresher	Project update, Q & A	15	
Mar-12			
Seattle	Auditor training	7	
Skagit Flats	Grower pre-audit assessment	7	5
		Auditors	Farmers & others
	Total	109	188

Bridging the GAPs Farm Guide Development

As the culmination of the project, based on key questions and experience gained throughout the project, WSDA developed the Bridging the GAPs Farm Guide, a friendly, attractive, clear and simple manual to help farms meet GAP/GHP standards and improve food safety practices on their farms. WSDA hired a photographer to join them on host farms to obtain photographs of real-life on-farm practices and systems that target readers would relate to. The guide highlights on-farm examples from Washington’s small farms, shares auditor tips for making the process go more smoothly, highlights frequently-asked farmer questions, and shares a variety of options for meeting GAP/GHP standards. It is presented in the order of the USDA GAP/GHP Audit Checklist, to help growers build systems and documentation that will be simple for auditors to review during an audit. The guide is available in English and Spanish, in binder form, with sample documents and templates from a range of sources, and each guide is provided with a flash drive of Word files of the templates so that farmers can easily adapt them for their own use. These guides and templates are all available for download on WSDA’s website at: <http://agr.wa.gov/Inspection/GAPGHP/Guide.aspx>. WSDA printed 500 copies of the English guides and 100 copies of the Spanish guides. Guides are being distributed at conferences and events in Fall of 2014 and into the future, until all have been distributed.



Additional Resources to Support On-Farm Food Safety Planning:

- An on-line Q & A captured the complex kind of questions that small, diversified farms have when trying to adapt the GAP standards to these kinds of operations;
- Online wizard to assist growers with planning for and scheduling an audit;
- Dissemination of two short instructional videos, both in English and Spanish.

Contributions to regional and national discussions regarding market and regulatory requirements for food safety, both current and future:

In addition to planned events to meet the specific grant deliverables, WSDA staff gave presentations at the following regional conferences to promote the project and disseminate GAP information:

- Cultivating Success, March 4, 2014
- Whatcom Sustainable Ag Conference March 7, 2014
- Camino al Exito, or Road to Success, February 4, 2014
- Bainbridge Graduate Institute, December 4, 2013
- Washington State Farm Bureau Annual Meeting, October 18-20, 2013
- Jefferson/Clallam County Farm to Table presentation, April 16, 2013
- WSU Small Farms Team Retreat short presentation, March 21-22, 2013
- Organicology Conference presentation, Portland, OR, February 7, 2013
- Bainbridge Graduate Institute webinar presentation to students, November 28, 2012
- Washington State Farm Bureau Annual Meeting presentation, Yakima, WA, November 14, 2012
- Tilth Conference presentation, Pt. Townsend, WA, November 11, 2012

WSDA collaborated with USDA staff on delivery of training and education, especially regarding bi-lingual educational resource development and gaining clarity on GAP standards in practice. This collaboration also provided feedback to USDA about the needs and concerns of small and diversified growers as they attempt to meet GAP/GHP standards.

WSDA staff shared information about FSMA implementation at all stages of the project, including sharing comment period information and copies of proposed rules, and encouraged growers to comment. Additionally, WSDA educators were able to take comments and concerns expressed during these events by small growers, and share them in national meetings and local FDA listening sessions.

GOALS AND OUTCOMES ACHIEVED

Development and dissemination of an on-farm food safety manual:

500 English and 200 Spanish language Bridging the GAPs Farm Guides, also available for download at <http://agr.wa.gov/inspection/GAPGHP>

The guide captures the many diverse lessons learned during the delivery of the education and outreach activities included in the project. Over three years the content evolved to include queries from on-site gardens at a university that serves garden-grown produce in its food service, to start-up farmers that are unclear about not only how to comply with GAPs, but what the value of compliance might be in the marketplace. Farmer Questions, Auditor Tips, and On-Farm Examples are woven into the guide, detailing real-world examples of best practices for growers working to improve their on-farm food safety. WSDA will distribute 500 printed guides in English and 200 printed guides in Spanish. Each guide includes fill-able templates that can be used to begin writing, implementing, and documenting on-farm food safety practices that will comply with Good Agricultural Practices.

This guide is provided at no cost to specialty crop producers and is intended to assist fruit and vegetable growers as they begin to implement and document good agricultural practices for on-farm food safety, and as they prepare for a third-party audit of those practices. The information in this guide is based on the USDA Good Agricultural Practices and Good Handling Practices Audit (GAP/GHP) standards. In order to provide accurate, useful information, the WSDA team

worked closely with WSDA auditors, who provide the audits in Washington State through a cooperative agreement with USDA.

WSDA's Bridging the GAPs project engaged auditors and educators to identify tips and best practices that will be cost-effective on small, mid-sized, and diversified farms, including those with livestock and other farm animals. The guide captures that information in order to help growers implement good on-farm food safety practices and provide auditors with a basic guide for issues of most concern to growers with smaller, diversified farms.

The guide generally follows the flow and structure of the USDA GAP/GHP Audit Checklist which provides a comprehensive look at the kinds of risks to consider when creating a tailored on-farm food safety plan. The checklist will be the guiding document followed by an auditor when conducting a GAP audit.

Four WSDA GAP Auditor trainings:

WSDA's licensed USDA GAP/GHP auditors—experts on standards for large-scale and single crop production—received hands-on education, tools and resources to help them understand the challenges of smaller-scale diversified producers and recognize record-keeping and food safety solutions that work for these farms, even though in some cases the solutions look different from what is in place in larger, single-crop operations.

Seven Grower pre-audit assessments:

The main goal of the Bridging the GAPs project was to identify and share best practices relating to on-farm food safety for small, mid-sized and diversified fruit and vegetable farms. The WSDA team coordinated on-farm grower pre-audit assessment where a regional farming community could gather to share examples of safe growing practices that meet the USDA GAP/GHP certification standards. Auditor participation in these tours was essential in order to provide interpretation of existing standards as they would likely apply to smaller-scale, diversified farms.

Two Producers' Roundtables:

WSDA coordinated and presented Producers' Roundtables with WSDA Education and Outreach staff, and a GAP lead auditor presenting an overview of the WSDA GAP audit program, introducing Bridging the GAPs, and facilitating audience discussion of on-farm food safety planning and practices. The events also addressed the Food Safety Modernization Act (FSMA) and the likely impacts that the proposed produce safety rule will have on diversified farms.

Development of an online wizard to assist producers in preparing for and scheduling GAP/GHP audits:

<http://agr.wa.gov/inspection/GAPGHP/requestforaudit.aspx>

Writing a food safety plan for the first time, implementing it, documenting it, and going through the audit process does take a significant amount of time to complete. The revised targets in Expected Measurable Outcome 1 are a reflection of this reality. In that sense the project does refer to long term measurable outcomes. WSDA expects an increase in small, mid-sized, and diversified specialty crop farm audit-requests, as fifty-seven percent (57%) of survey respondents indicated that they plan to seek GAP certification within five years, and an additional twenty percent (20%) indicated they do intend to become GAP certified, but are uncertain as to the timeframe.

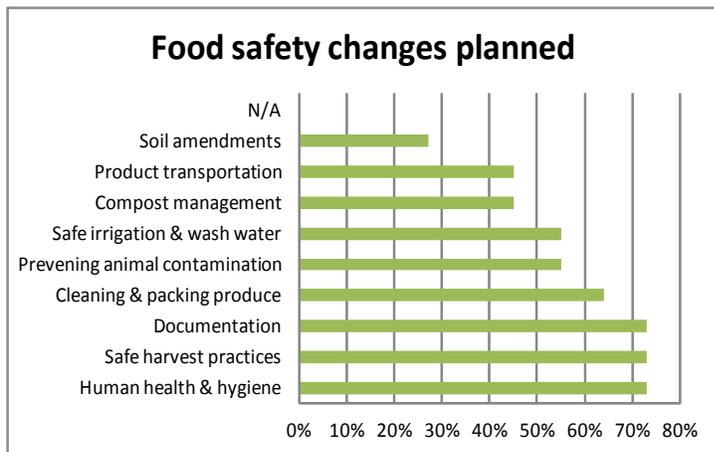
Farmers are also anxiously awaiting the final Produce Safety Rule in the Food Safety Modernization Act, and are particularly concerned about exemptions to the Produce Safety Rule, especially whether the exemption applies to their operation, and if it does, whether it would benefit or harm their marketing efforts to apply it. Additionally the water testing requirements shown in the draft rule has the potential to significant impact their irrigation and water testing practices. The guidance provided by Extension and industry advisors on this topic gave growers knowledge about thresholds of acceptable microbial content in water sources, and how they can manage the required water testing regimes in the future. As noted, misperception about the procedural and technical requirements of GAPs continues to be a challenge, and the same is true about the draft Produce Safety Rule. Bridging the GAPs was able to reached growers with guidance and resources that will assist them in making informed, strategic decisions about on-farm food safety into the future.

The activities conducted as part of the project were well-targeted to reach the growers, agriculture extension professionals, and GAP audit staff (WSDA and USDA) who would benefit from the experiences and resources that were delivered. The grower pre-audit assessments were especially useful as a hands-on classroom where audit staff and farmers could have informal, but detailed conversations about GAP standards and how to meet them. The goal of reducing the barriers to access to GAP has been accomplished as a result of growers and auditors working closely together, and getting advisement from industry (wholesale buyers, certified laboratories), with additional guidance being provided by USDA GAP audit staff.

Goal 1: The market barrier of GAP/GHP audits will be reduced by effective education of small to mid-size specialty crop growers, processors, and WSDA auditors.

For this goal, WSDA set targets to measure the progress or intention of farms to improve food safety practices, which are the building blocks of successful GAP/GHP audits:

- Target A: 25% of farms attending events plan to request an audit in the next five years. There is not a clear baseline for this, but the education and outreach event evaluations provide an overview of percentage of evaluation respondents intending to request audits in the next five years.
 - RESULT: 57% of respondents indicated plans to request a GAP audit in the next 5 years, and an additional 20% indicated they do plan to request a GAP audit but are unsure on the timing of when they will do so.
- Target B: 75% of farms attending events plan to make some change in on-farm food safety practices based on what they learn at the events.
 - RESULT: 71 of 75 or 95% of survey respondents indicated that they would make a change or improvement in their on-farm food safety practices based on knowledge gained at the workshop, training, roundtable or other WSDA Bridging the GAPs educational event.
 - RESULT: The end of project survey is summarized in the chart below.



- Target C: Five new farms who received information through the Bridging the GAPs project will successfully complete audits by the end of the project period (September 2014).
 - RESULT: After participating in Bridging the GAPs events, trainings, workshops and/or roundtables the nine (9) smaller, diversified specialty crop farms that were previously uncertified, successfully completed their WSDA GAP/GHP audits.

NOTE: The above are amended targets. At the conclusion of year one of the project, it was clear that WSDA would need to amend the targets associated with **Outcome 1, reducing the market barrier of GAP/GHP audits through effective education of WSDA auditors, and specialty crop producers and processors.** The three targets were subsequently adjusted because they depended on an increase in farms receiving a GAP/GHP audit and that increase was not occurring

in expected numbers. Fewer than anticipated farms were ready to request GAP/GHP audits at that time, though the demand for advisements and information was high, especially since many farms were adapting their food safety practices toward a goal of achieving a successful audit in the future. For most of the farms benefiting from this project, the steps to a GAP/GHP audit are numerous, and more time was needed for them to conduct the planning and adaptations to farm practices necessary to prepare to request an audit.

Previously the targets were:

- Target A: A 20% increase in the number of GAP/GHP audits conducted and specialty crop grower acreage audited for small to mid-size growers by the end of Year 1; 10% increase in year 2.
- Target B: A 10% increase in sales for small to mid-size specialty crop growers through GAP/GHP audit.
- Target C: Maintain existing small to mid-size specialty crop grower sales through GAP/GHP audit (sales that would have been lost if GAP/GHP was not achieved).]

Goal 2: Timeliness of audits conducted to meet industry needs.

This measures how well the timeline of scheduling and conducting audits meets the industry's need for prompt service. Growers submit requested dates for audits during specific phases of the season so that their pre- and post-harvest practices can be verified. Auditors schedule their on-farm inspections in order to be responsive to the grower's harvest, packing and processing schedules. The baseline was that 100% were conducted on dates scheduled by grower, but there was concern that increased demand would make that difficult.

- RESULT: 100% of GAP/GHP audits across the state were completed on the dates as scheduled.

Goal 3: Improved WSDA customer service

This goal considers the improvement of customer service, and the overall satisfaction of growers' experience with preparing for and being audited.

- RESULT: WSDA did not conduct customer service surveys as part of their audit program. Instead, they encourage growers to provide feedback to USDA, and provide the contact information to do so. USDA reports that most if not all the responses in their performance evaluations of auditors have been very positive. When they receive questions or concerns from growers, the issues are generally only negative toward specific policies and not to the auditors themselves. Additionally, USDA reports that their experience with WSDA auditors is that "all are very professional in their delivery and consistent in the way items are assessed within the audit." USDA credited this in part to WSDA auditors attendance at Bridging the GAPs farm walks.

BENEFICIARIES

Those who have benefited from the completion of this project and its accomplishments include:

- WSDA and USDA Audit Staff who participated in auditor trainings and/or on-farm workshops - The audit staff gained insight on the large and growing interest in food safety planning and audit that diversified farms are expressing. They also discovered unique and innovative food safety management practices on these farms that will assist them in doing audits of diversified farms in the future.
- Specialty crop farms that participated in the Producers' Roundtables, on-farm grower pre-audit assessments, and/or outreach events had the opportunity to bring their questions and concerns to their peers, and to representatives of the agriculture industry and agriculture regulators. By getting answers to their questions these growers are better informed about the procedural and technical side of food safety planning and audit, and they are able to share that knowledge with their peers, who may still have misperceptions about those issues.
- Latino growers benefited from the development of new resources in Spanish, the translation of existing WSDA and USDA tools into Spanish, and workshop opportunities with interpreters and a Spanish-speaking auditor.
- Agriculture Extension professionals attended many Bridging the GAPs events and meetings and as a result they are better prepared to answer constituents' questions, and consider these questions when formulating their own or contributing to their peers' research.

This project reached closed to 200 farmers, educators and other advocates with new knowledge about on-farm food safety as it pertains to good farm practices and/or for audit, and in order to access a new market. This is an excellent risk management strategy for growers regardless of the farm's audit status or their market access. If a food safety problem emerges in which their product could be implicated, having food safety practices in place, supported by strong record-keeping, will allow that grower to quickly determine whether or not their product could have been the cause of the problem. **Nine new small, or mid-size diversified farms successfully got WSDA GAP/GHP audits for the first time.**

The project reached approximately 20 Latino growers, the fastest growing segment of farmers in Washington, with bilingual on-farm workshops on food safety – one in Yakima County and the other in Whatcom County. In addition the project outreach team translated two instructional videos into Spanish to assist Spanish speaking growers with better understanding the structure of the GAP Audit, and the value of it in the marketplace. **These 20 growers are better prepared to succeed in the marketplace of their choice as a result of a stronger understanding of how to meet the GAP standards, and the value it has in their businesses.**

Technical assistance resources addressing complex management questions that consistently arise for smaller, diversified farms are now easily available to any grower, at no cost to them. The web-based Q & A on GAP standards, with the new Bridging the GAPs Farm Guide and its adaptable templates, puts valuable tools in the hands of growers that have been anxious and concerned about market and regulatory changes. **A barrier to GAP practices and audit has been decreased as a result of this work, which has potential to impact the economic prospects of all small farms in Washington.**

LESSONS LEARNED

One of the positive lessons learned is that the GAP/GHP Audit is quite adaptable. While the food safety standards for GAP are clearly defined, what has emerged through the education and outreach conducted is that there are a wide variety of ways a small, diversified operation can adapt to the practices, without necessarily causing fundamental changes to the ways that the farm operates. In fact, in many cases the farms simply needed to implement a documentation system in order to accurately capture the good practices already in place. WSDA GAP auditors learned a lot from working directly with these farms. Auditors were able to see the innovative ways that these farms have adapted in order to meet standards, and growers began to see the ways in which the GAP standards are able to be interpreted on the basis of the kinds and level of risks that are in place in these smaller farms.

Growers are increasingly interested in learning and talking about on-farm food safety, based in part on buyer requests, but also on awareness of the FDA Produce Safety Rules which are still in development.

A negative lesson to share, however, is that there continue to be misperceptions held regarding the stringency of practices required for a successful audit and the level of expense associated with GAPs practices and audits. Additionally there continues to be anxiety about the upcoming FDA Produce Safety Rules, which have been delayed. Continuing to offer education and additional guidance, and broadly circulating the resources developed in this project will help to address these misperceptions.

All outcomes were achieved.

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ADDITIONAL INFORMATION

This project did not propose or track in-kind or cash matching donations. WSDA did provide in-kind resources in the form of supplying goods and services such as office space, motor pool vehicle use, phones and computers for the duration of the project. All are provided via links in the report text.

PROJECT #9

Project Title: Improving Access to Institutional Markets by Reducing Regulatory Barriers

Partner Organization: WSDA Food Safety & Consumer Services Program (WSDA)

PROJECT SUMMARY

In 2011, increasing numbers of buyers and producers were investigating farm to school and farm to institution markets, and the regulatory environment surrounding the markets was undergoing significant changes, resulting in uncertainty and reluctance to enter the farm to school marketplace (from both buyers and sellers). Some key regulatory issues affecting producers seeking to sell to institutions included buyer requirements for food safety certification, federal rules on geographic preference and bidding procedures when using National School Lunch Program funding, and changing school nutrition standards (which include an increased focus on a variety of fresh fruits and vegetables, as well as new labeling and health standards for processed food items). The WSDA Farm to School team is consistently on the front lines in evaluating, understanding and preparing producers and institutional buyers to successfully navigate the regulatory landscape and successfully implement farm to school programs. This project aimed to educate, inform and support Washington buyers and sellers to increase farm to institution sales of Washington-grown specialty crops by sharing up-to-date knowledge and by prioritizing continued analysis of changing regulation and appropriate market response for buyers and sellers. The project also supported farm to school promotion and school site implementation by developing and sharing resources, posters, recipes and more to schools and other institutions.

Building on previous work to reduce regulatory barriers and improve confidence in farm to institution marketplaces for buyers and sellers, the Farm to School Team in the Office of Compliance and Outreach aimed to:

1. Educate school buyers on regulatory requirements at the state and federal level for geographic preference of Washington-grown specialty crops and pilot sample bid language in 2-3 school districts.
2. Educate Washington-based food processors about school meal market opportunities and recent federal nutrition standards, and encourage sourcing of Washington specialty crops as ingredients in new products development for schools.

Expand online foodservice toolkit to add self-assessment materials, equipment recommendations, and recipes that meet standards for schools, childcare and senior meal programs, to support buyers to incorporate Washington Grown specialty crops into their programs and promote them to customers.

In 2011, when this grant was initiated, school food buyers were facing new challenges adjusting to new nutrition standards and purchasing requirements that dampened their interest in buying Washington-grown specialty crops, but also provided opportunities in that schools were required to serve more fruits and vegetables in greater variety, and were offered flexibility in purchasing to support local sourcing. USDA had just finalized the Geographic Preference Option rule in order to increase flexibility for schools seeking to purchase locally-grown food to serve in their federally-funded child nutrition programs. Washington State law already included a provision exempting purchases of Washington-grown food from lowest-cost purchasing requirements. Both provisions provided flexibility for schools seeking to purchase Washington-grown food, but there was uncertainty as to the appropriate procedures for them to do so. An earlier project, through a grant from the Centers for Disease Control and Public Health-Seattle & King County, had funded legal analysis to clarify the regulatory requirements, along with development of a comprehensive guide to educate schools on ways to buy Washington-grown food. That publication, "A School's Guide to Purchasing Washington-Grown Food," is a valuable resource to increase confidence of school buyers and open emerging school markets to specialty crop growers in the state. However, given the complexity of the topic, the necessity for schools to significantly alter their familiar purchasing process in order to buy more local food, and their general risk aversion when faced with regulatory changes made it clear that more direct outreach, training, and testing of the models presented in the guide would be necessary to actually increase the ability of schools to buy locally-grown specialty crops. At the same time, USDA launched new meal pattern and nutrition standards that offered opportunity for specialty crop growers by requiring a wider variety and more servings

of fruits and vegetables, but school districts faced challenges in adapting their purchasing, budgets, and kitchen operations to meet the new standards, and many felt that they no longer had time to focus on farm to school programs in their schools. They needed support, information, and tools to make it easier for them.

At the beginning of this project, WSDA was also hearing from partners working with senior and childcare programs to increase local sourcing and education relating to food and health. These partners highlighted the need for more recipes that met these providers' needs, along with tips and resources to help them integrate local specialty crops into preschool education, garden programs, and food service.

The geographic preference workshops, and pilot projects in the SCBG project addressed these challenges by providing detailed workshops, disseminating binders and sharing templates to help school buyers with purchasing local specialty crops. At the same time WSDA targeted food processors using specialty crops, to promote schools and other institutional markets, to increase sourcing of Washington-grown specialty crops and encourage more product development to make farm to school easier on schools, which perpetually face budget, staffing, and equipment challenges, but who especially needed processed fruits and vegetables to meet their new nutrition standards. WSDA also continued to improve the online Farm to School Toolkit with new seasonal recipes, harvest posters highlighting Washington specialty crops and a Farm to Preschool toolkit section responding to requests from those supporting child care and preschool providers. These project activities would result in tools and resources to make it easier for schools and other institutions to provide more specialty crops in their meal programs.

In a previous SCBG project, *Farm to School: Building New Markets for Specialty Crops in Schools*, WSDA had built an online farm to school toolkit (www.wafarmtoschool.org) to house resources and information. That provided a clearinghouse site for schools, and those seeking to sell to them, to find information about farm to school programs. The online farm to school toolkit has been well-received, and has inspired requests in other institutional sectors for WSDA to include more resources to meet their needs. During this current project, WSDA was able to more fully populate that site with resources for schools, processors, for childcare and preschool providers and other institutions, by adding more detailed information, more recipes for institutional food service providers, and updated and time-tested tools and templates for purchasing locally-grown specialty crops, and meeting new challenges in this marketplace. Additionally, this project provided funds to develop a Washington specialty crop poster series for use in institutions, to build on the Washington Grown Food Kit recipe and education toolkit, but with the added benefit of being designed so that they can also be used to tie institutional promotion and education efforts to parents and communities by linking up schools, preschools, farmers markets, etc. with the same poster campaign.

The previous SCBG provided training for farms and schools to inspire and assist them to enter and expand their farm to school purchasing and build regional networks, and also conducted surveys to gauge needs and market interests of farms and processors, in addition to farm to school purchasing needs and barriers as reported by schools. In that work, it was clear that some schools require more processed products than many farms can supply directly. In this project, WSDA used that survey data to conduct outreach and develop materials to recruit and assist food processors to source more Washington-grown ingredients, develop products that meet school market needs. This included information on products schools want and need to meet their new nutrition standards, as well as information about the documentation and systems required to sell to schools. The webinar also built on relationships with Oregon Department of Education and Department of Agriculture, so that the webinar would also benefit specialty crop growers in Oregon.

PROJECT APPROACH

This project provided for a range of services, training opportunities, technical assistance, and resource development to support farm to institution in Washington State. Those are detailed below.

Procurement and Geographic Preference outreach and education, including Technical Assistance:

Workshops

WSDA staff developed a curriculum and workshop series, “How to Buy and Serve Washington Grown Food in Schools.” Attendees receive a binder copy of *A School’s Guide to Purchasing Washington-Grown Food* and were guided through a discussion of appropriate methods to increase their use of Washington-Grown food. Each of the seven workshops was planned and conducted with local partners in each of the regions, and included content tailored to needs expressed in the region. For some, this included school garden food safety and regulatory information, for others, this took the form of a networking buyer-seller meeting. The curriculum was adapted and improved over the course of the series, based on feedback and staff review.

- Mt. Vernon, WA – February 11, 2013. Conducted in partnership with OSPI’s Northwest Educational Services District and the Whatcom Farm to School Support Team. 18 people attended the event, and eight evaluations were returned.
- Tacoma, WA – April 22, 2013. All nutrition directors in Western Washington were invited to this relatively centrally-located event, and notice was sent to school purchasing officers via the Washington Association of School Business Officials. The event was a partnership with the Tacoma/Pierce County Health Department, and 18 people attended, with seven of them returning their evaluations.
- Wenatchee, WA – May 1, 2013. The North Central Washington event was attended by 15 school nutrition professionals. The local Educational Service District (171) partnered by providing a location to host the event and providing snacks. Only 5 of the attendees returned evaluations.
- Longview, WA – October 7, 2013. The event was a partnership with the Cowlitz County Health Department, with other local health department contacts assisting by encouraging their school districts to attend. Eleven people attended, and only three of them were school food service directors; a disappointing turnout, even with health departments encouraging attendance. Others in attendance included State and local health jurisdiction representatives, a WSU Extension director, an Oregon partner from Ecotrust, and a dietetic intern. Only four attendees completed evaluation surveys, and of those, only one was a school food service director. Overall, feedback was positive, and it is likely that the attendees will be ambassadors to share this information with their stakeholders and communities, even though not many school food service buyers attended.

The following three workshops were held as a mini-series, over three days. OSPI Child Nutrition Program and local health department contacts assisted us by encouraging school districts to attend. Representatives from each region had requested assistance with connecting to vendors who supply locally grown produce in their areas, so in each workshop we included an hour-long Vendor Networking Session. In each networking session, farms and distributors were provided a brief update of the competitive bidding rules that schools must follow when purchasing food. Then vendors introduced themselves and the Washington-grown produce they offer, and participants were able to ask vendors questions. Then the groups had time to mingle to exchange contact information and begin developing purchasing relationships.

- Richland, WA – March 18, 2014. Three school districts and four producers were represented.
- Spokane, WA – March 19, 2014. Six school districts, one local health jurisdiction, seven producers and two distributors were represented.
- Ellensburg, WA – March 20, 2014. This final workshop was held in the center of the state, to offer the best location for those who were unable to attend their regional events. Six school districts, two local health jurisdictions and five producers were represented.

Washington Sustainable Food & Farming Network hosted Fresh Food in Schools Summits in 2012 (Western Washington) and 2013 (Eastern Washington), and invited WSDA to speak and conduct outreach to raise awareness of upcoming trainings. The 2013 summit also included a WSDA session on geographic preference and local food procurement.

As part of the **technical assistance and information relating to geographic preference and school food procurement**, WSDA staff coordinated with peers and leaders in the National Farm to School Network and in USDA’s Farm to School Program, providing feedback on guidance—both existing and in development—and providing information to assist those organizations in their education and outreach relating to local food procurement and geographic preference.

Procurement Pilot Projects

- Walla Walla Public Schools – The main contacts engaged in this pilot district were WSDA Education and Outreach staff, Walla Walla School District’s Nutrition Director, and a short-term Farm to School Coordinator. WSDA staff also met with the district’s Superintendent and business officers to support their efforts and decision-making regarding geographic preference. WSDA delivered an in-depth hands-on training for nutrition staff, using “A School’s Guide to Purchasing Washington-Grown Food,” to introduce participants to the regulatory framework. The initial training was augmented by providing district staff with technical assistance, and sharing templates and resources developed throughout this time period in pilot work with other districts.

WSDA provided ongoing technical assistance and several phone and in-person meetings with Walla Walla Public Schools, and shared templates, vendor surveys and evaluation reports from a concurrent (separately funded) pilot project with the South King County Farm to School Collaborative. Walla Walla developed a purchasing method using similar but simpler Requests for Quotes as those in South King County and conducted procurement via RFQs for fall 2013, resulting in purchases of 10 produce items from six farm vendors in September. In addition to those fall purchases, the district purchased 12-15 produce items from eight vendors (mostly farms, along with a couple of produce markets) for their September 25, 2013 Taste Washington Day celebration.

In January and February 2014, WSDA staff consulted with Walla Walla to plan a forward contract process that would work in their region. Only two responses were received out of twenty-two vendors contacted in the forward quote process, likely due to the fact that requests were sent via email, and many of the smaller vendors are accustomed to phone or in-person communications. Successful purchases in previous RFQs have been conducted by gathering quotes by phone.

Walla Walla Public Schools most recently promoted and served a Washington-grown menu for the October 1, 2014 Taste Washington Day celebration. Going forward the district will be purchasing and promoting Harvest of the Month items, with a highlighted item being served on the 3rd Tuesday of each month.

- Arlington School District - Arlington School District joined the project as the second geographic preference/local purchasing pilot project for this grant in late 2013, and WSDA staff met with the Nutrition Director in Arlington and followed up with draft procurement documents for his review. The district planned to work with WSDA staff to implement a call for quotes to trial a forward contract for limited produce items to be awarded in late winter for purchases in 2014. Unfortunately, in late winter/early spring of 2014, Arlington School District decided that they did not have time or capacity to participate, and therefore the forward contract was never attempted. (WSDA had worked closely with the Arlington School District and with fellow partners Washington Sustainable Food & Farming Network to support local food purchases for the previous 2-3 years, and Arlington trialed a “Fresh Sheet Model” of applying a geographic preference in informal procurements which is now included in WSDA’s publication “A School’s Guide to Purchasing Washington-Grown Food.”)
- Riverview School District
WSDA provided one-on-one guidance and overview of “A School’s Guide to Purchasing Washington-Grown Food” to the Nutrition Services Director at Riverview School District and attended a planning meeting with the district and local farmer and farm organization partners to plan a Harvest of the Month program that would match local seasonal product availability. At that meeting, WSDA provided an overview of appropriate purchasing methods for the project and offered additional technical assistance. Riverview School District sent out a request for information to farms in May, but had very low response. They re-sent it in June and received a total of four vendor responses. The district has since contacted these vendors for quotes for purchases in September, October, and November and purchased cucumbers, broccoli and cabbage for those events. Riverview School District intends to continue Harvest of the Month purchases using an informal Request for Quotes system with local farms, but reports that the process is still cumbersome and requires her to make phone calls and pick up produce, and that the produce requires additional labor hours to prepare for the schools. WSDA hopes to be able to continue to provide basic technical assistance to

transition the project into some more sustainable methods and potentially identify minimal processing partnerships to assist with the labor and distribution issues.

- Related work in CTG project with South King County Farm to School Collaborative: One-on-one procurement guide introduction and training in Auburn School District and support for Renton and Auburn School Districts in their local purchasing pilots funded by a CDC *Community Transformation Grant* in partnership with Seattle Children’s and Public Health – Seattle & King County.

Professional Development to inform procurement work:

- USDA School Meal Pattern training at OSPI, Spring 2012 – Project coordinator learned about new school nutrition and meal standards, to inform procurement trainings and align messages. This information also guided much of the work on the processor webinars and resource development.
- USDA Produce Safety University, April 2012 – Project Coordinator learned a great deal about procurement specifications, produce quality, and safe handling and storage of product, to include in workshops and on toolkit site.

Processor Education:

- WSDA presented a two-part webinar, in partnership with Washington’s Office of the Superintendent of Public Instruction (OSPI) and Oregon Department of Education, and in consultation with Oregon Department of Agriculture. The webinar was promoted via email through WSDA’s Food Safety Program, sending it to all licensed food processors with emails on file, and through the NW Food Processors Association, which has members throughout Washington and Oregon. The first webinar, “Farm to School Supply Chains in Oregon and Washington, highlighted the opportunity of farm to school, shared relevant findings from WSDA’s Farm to School surveys of farmers, schools, and processors, and discussed the farm to school supply chain from farm to processor to distributor to schools. The second, “Selling to Schools – The Details,” provided an overview of the school purchasing process and meal pattern, food safety documentation, and product labeling. Turnout was small, with 6-8 participants on each webinar, but the archived webinars are available for download in hopes that others will be able to watch them at another time.
- Based on the information in the webinar, WSDA created 4 fact sheets to share with food processors:
 - [Selling to Schools 101](#)
 - [Washington Schools Top 10 Most Frequently Purchases Minimally Processed Fruits and Vegetables](#)
 - [Farm to School Produce Pack Size Chart for the “Top 10” items](#)
 - [USDA School Meal Pattern Basics](#)
- The resources were originally posted on a “Resources for Food Processors” page on the WSDA Farm to School Online Toolkit but upon review it became clear that these resources are also very useful for specialty crop growers, even if they are not doing much if any processing. The page is now titled: “[Resources for Farmers and Food Processors](#)”. In addition to the webinar archives and the Fact Sheets, the page also contains visuals and links with more details on the school meal pattern and USDA nutrition standards for snacks sold in schools, as well as links to further resources for licensing, USDA Foods, and a publication examining distribution issues for scaling up farm to school.

Toolkit Expansion:

WSDA significantly expanded and improved the resources and tools available to schools on the WSDA Farm to School Toolkit, and added resources targeting child care, preschool and senior meal programs, as well as resources and fact sheets that improve the ability of farms and processors to meet the institutional market demand. This expansion and resource sharing are as follows:(For those projects listing non-SCBG funding sources, *this project provided funding for staff time to build web pages and make the resources available to stakeholders around the state and nationally.*)

UPDATED PAGES, WITH NEW RESOURCES AND TOOLS:

- [Getting Started](#) page for schools, with information and free download of the *WSDA Farm to School Start-Up Kit*, created during a previous pilot project with Kent School District. *Documents included in the kit include: self-*

assessment tools, equipment recommendations, kitchen protocols for using winter specialty crops, and promotional materials to be adapted for cafeteria education and promotion of Washington-grown foods and specialty crop producers. The Start-Up Kit was made possible with funding from Public Health-Seattle & King County and US Centers for Disease Control and Prevention.

- [Washington-Grown Food Kit](#) – updates, including:
 - Adapted to add the search and category capability to separate out senior and childcare recipes.
 - A total of 34 child care recipes featuring Washington specialty crops, along with related seasonality and nutrition information, were added to the Washington-Grown Food Kit, as a follow-up to the Farm to Table Project with the City of Seattle Human Services Department. (recipes developed with *Communities Putting Prevention to Work* funding from Public Health-Seattle & King County and US Centers for Disease Control and Prevention)
 - Added new recipes from school districts, highlighting beans, cabbage, carrots, corn and garlic.
 - Created new pages and nutrition info for asparagus, beets, Brussels sprouts, celery, collard greens, kohlrabi, mushrooms, plums, peppers, rutabaga, raspberries, spinach, and sweet potatoes. Updated the pages for beans, carrots, garlic and kale,
 - Updated the pages for potatoes, beans, carrots, garlic, kale, yams, onions, parsnips, pears, potatoes, and yams.
 - WSDA partnered with the Office of the Superintendent of Public Instruction (OSPI) to have some recipes in the Washington-Grown Food Kit analyzed to align with the USDA meal pattern and nutrition standards. Several recipes were updated in this way, making them more likely to be used by school menu planners.
- [School Gardens](#) page – School garden resources were added, with a specific focus on food safety resources for school garden coordinators and kitchen staff who work with them. School gardens increase student interest and acceptance in a wide variety of specialty crops. Resources added include:
 - Resources to the “[Activities and Education](#)” page,
 - A new resources to the “[Food Safety in the Garden](#)” page
 - A Wisconsin example of school garden language for school wellness policies and
- [In the News](#) page – added current news:
 - FY2014 USDA Farm to School Grant recipients announcement
 - Media – Taste Washington coverage from 2013 and 2014, Wenatchee School District highlight from Bon Appétit online, and the *Washington Grown* TV show highlighting Walla Walla Public Schools Farm to School program
 - Complete listing of 2014Taste Washington Day events, with photographs and descriptions, as reported by schools and media outlets.
 - Event – National Farm to Cafeteria Conference information
- [Taste Washington Day](#) page and [Trainings and Mobile Workshops](#) page, – consistently updated to reflect current activities, new Taste Washington Day templates, and other opportunities.

NEW PAGES

- [Procurement and Geographic Preference](#) page, with the procurement guide, “A School’s Guide to Purchasing Washington-Grown Food”. The full guide is available for download and the link has been provided to stakeholders across Washington and nationally. The guide, which has received recognition from the USDA Farm to School Program and others, also provided the core information and resources for the Geographic Preference workshops. This page also hosted information about workshops for school buyers as part of this project. During 2014, updated procurement templates were added to the page, with purchasing documents tested during pilot project work with South King County school districts (pilot funded by a CDC *Community Transformation Grant* with Seattle Children’s and Public Health – Seattle & King County).
- [Farm to Preschool Kit](#) pages were added, in response to requests from agency representatives working with preschools and child care centers. WSDA had previously referred preschool and childcare stakeholders to the National

Farm to Preschool page, but local partners expressed a need for a Washington State based site to share resources and focus on specialty crop seasonality and topics specific to this state. Sub-pages in this kit include:

- [Farm to Preschool Curriculum](#)
- [Engaging Children in Farm to Preschool Activities](#)
- [Health and Safety for Childcare Meals and School Gardens](#)
- [Nutritious Meals and Snacks for Preschoolers](#)

- [Salad Bars](#) page was also added, with links to existing tools and resources. The Salad Bars page includes downloads of *SAFE Salad Bars in Schools: A Guide for School Food Service* and student-created peer education materials for schools to use to educate students about safe and healthy choices when using school salad bars. (The SAFE Salad Bars guide and peer education materials were developed through a grant from the Association of State and Territorial Public Health Nutrition Directors, in partnership with several state agencies and the FEEST Program at the White Center Community Development Association.)

- [Resources for Farmers and Processors](#) page was added, and includes archived webinar downloads, WSDA Farm to School Fact Sheets aimed at food processors and farmers doing minimal processing and packing, and links to more detailed information about school meal program nutrition standards, meal pattern, and USDA Foods program.

- [School Wellness Policy](#) page, with links to templates, information and examples of how to incorporate farm to school principles and commitments into schools' required wellness policies

- [Farm to School Cookbooks](#) page – to highlight the following cookbooks:
 - “Washington State Schools ‘Scratch Cooking’ Recipe Book” by the Office of the Superintendent of Public Instruction
 - WSDA adapted and shared a recipe book for child care centers in Seattle and King County and highlighted specialty crops to educate about what is available in Washington State and encourage sourcing from Washington specialty crop producers.
 - “New School Cuisine: Nutritious and Seasonal Recipes for School Cooks by School Cooks” from Vermont FEED
 - “Cooking with California Food in K-12 Schools” from the Center for Ecoliteracy
 - Other cookbooks to be added in the future, as WSDA identifies resources that will be useful to support farm to school in Washington.

- [Promotion and Education Materials](#) page, to increase visibility of promotional resources for schools. The page houses WSDA’s new Washington specialty crop posters, available for download for schools and other institutions, along with links to Harvest of the Month posters and educational resources from Seattle Public Schools and Whatcom Farm to School Team, and convenient links to the Taste Washington Day page and National Farm to School site.

Presentations and Outreach to Promote WSDA’s Online Farm to School Toolkit and provide farm to school expertise:

- WSNA Fall Workshops in Toppenish, WA and Des Moines, WA to highlight the resources and tools available on the online toolkit and to request input and recipes to further enrich the site. October 2012.
- Other presentations highlighting web resources and Washington specialty crops for schools were funded by a USDA Farm to School Implementation grant from December 2012 to May 2014.
- Washington State Farm Bureau presentation on Farm to School, highlighting web resources that support farms in selling to schools. November 2012.
- WSDA had an unplanned opportunity to present on a webinar hosted by Washington State Department of Health on September 16, 2013, to share information about local food procurement and geographic preference, and to

encourage stakeholders to use our toolkit resources and come to WSDA for technical assistance and training relating to purchasing Washington-Grown foods.

- WSDA staff shared Farm to Preschool resources from the online farm to school toolkit at the Childhood Obesity Prevention Conference in Seattle, Washington, on April 3rd, sharing the online toolkit recipe database and educational resources with preschool providers and nutritionists in Washington State. A second childcare/preschool presentation was made at the Mountainview Daycare Nutrition Program Annual Training Conference on May 4, 2013 for more than 60 participants.
- The US Centers for Disease Control have also expressed interest in the “Farm to Table” childcare project, and WSDA coordinated with project partners to present on a CDC stakeholder call for their Early Childhood Education group on June 26, 2013. WSDA presented to share online toolkit resources relating to farm to childcare with a national audience.

Results

As a result of this project, food service operators increased their knowledge and confidence about buying and serving Washington grown and processed food in settings from pre-school through high school. In survey evaluations at procurement workshops, 62% of school food respondents said they WILL purchase Washington-grown food for their school meal programs within 6 months following the events, and another 35% said they MAY do so in that six months. 84% of attendee/respondents reported that they would recommend the training to others. (WSDA used feedback from early events to improve later trainings. The first event had the lowest positive response to this question and the number was 100% in 5 of 7 events.)

Schools reported through an end of project survey that at least 123 new purchasing relationships were formed with farms or food businesses during the grant period. Among schools that were already buying Washington-grown produce from farms or other businesses at the start of the grant period, nearly half (48%) indicate they have increased purchases from those farms or businesses during the grant period.

A strong pilot project requires active collaboration with diverse partners, sometimes in remote locations. Overall, Walla Walla Public Schools reports that their Nutrition Services program spent an increased portion of their food budget on local foods supporting their local economy and fostering pride in their local farming heritage. They also report that students tried new foods and voted their preferences during monthly Harvest of the Month tastings while making a connection with a local farm. Results indicate that, while some foods are more popular than others, every taste test showed the majority of tasters liked the samples of everything from Bosc pears to winter squash. Harvest of the Month has also broadened the recipe resources for the district as staff developed and cooked new recipes for garbanzo beans and lentils. They also report over a dozen new purchasing relationships with farms or food businesses developed during this project period, along with an increase in purchases from farms and businesses they had been purchasing from before. Local purchases as a proportion of produce budget grew from an estimated 0.5% in 2011/12 school year to up to nearly 3% in the 2013/14 school year. With the loss of the USDA Farm to School grant that funded some of the work at the district level, the district has decreased farm to school efforts, though they will continue purchasing local produce during peak season through the informal request for quotes system. Riverview School District is still in early stages as a pilot, but WSDA support through this project has given them confidence to use a request for quote system to purchase locally-grown foods for their Harvest of the Month and Taste Washington Day events, and they plan to continue.

Food service professionals have access to guidance on seasonality and finding regional farms that are interested in working with schools. Nutrition directors requested and WSDA provided updated recipes that feature Washington grown specialty crops, especially suited to meeting the seasonality challenges of the growing season in this region and to the nutrition standards for their specific programs.

WSDA’s web-based resources are now reflective of the diverse institutional marketplace for Washington growers and processors of specialty crops, especially for schools and preschools. A current follow-up specialty crop block grant will be used to continue development of the online toolkit for farmers, processors, distributors, state agency buyers and employee cafeterias.

Food processors have new resources to guide their market research and product development work for institutional sales. These are markets which have consistently been noted as markets of interest for specialty crop growers and processors responding to the statewide WSDA Farm Survey and Processors Survey.

Accomplishments

Schools are able to initiate new purchasing relationships with food producers and processors, expand existing purchasing relationships, and do both with greater confidence that they are following all of the requirements of state and federal procurement rules.

Nearly 100 individual food service professionals, growers, processors, public health representatives, and other advocates have new knowledge of the regulatory framework that underpins school buying requirements, as a result of attending a workshop on “A School’s Guide to Buying and Serving Washington Grown Food”. In a follow-up survey of all districts in Washington, 14 districts report using geographic preference in informal quotes or formal bid solicitations, 27 districts report buying locally-grown produce through informal requests for quotes, and 38 districts indicate that they request locally-grown produce through their contracted distributors. All of these methods were explored and shared during this grant project, with a goal to support schools in identifying methods that work best for their food service operation. For comparison, 22 districts noted that they do not specifically request locally-grown produce in their purchasing. Cross-pollination between school districts around the state was facilitated through the purchasing pilots and technical assistance. Purchasing templates were tested and shared between districts, for adaptation and use in their procurement, increasing understanding and improving methods for many districts.

The project has facilitated more producers and processors of Washington-grown food to enter and/or expand this market for their products.

Conclusions

With ongoing market assistance, school and institutional settings are ripe for development of new markets for farms and food processors. 93% of school nutrition directors see Farm to School as positively impacting local economies, 91% indicate Farm to School projects bring high quality, fresh product to their meal service. Farms are seeking information on how to access this new market. Thirteen (13%) percent of farms responding to WSDA’s 2014 Survey of Farms have sold their products to schools either directly or through a cooperative group or wholesaler. It is notable however, that an additional 47% are interested in selling their products to schools.

Washington food processors who use specialty crops report that locally grown and Washing grown are qualities their customers are asking for. 52% of processors report that there is increasing demand for products to be made with ‘locally grown’, and 42% report increasing demand for products made with ‘Washington grown’ ingredients. School and farm surveys indicate a need for processors to play a strong role in farm to institution, particularly in the area of minimally-processed fresh produce, due to limited capacity on the farm and in school kitchens to process produce for consumption.

With changing regulatory frameworks for nutrition, purchasing, and soon food safety (as a result of the Food Safety Modernization Act), there continue to be unmet needs for guidance that would allow the new rules to be integrated, and farms and food processors to understand and overcome the barriers to accessing and/or expanding these markets.

Recommendations

While significant impacts have been realized as a result of this project, the food procurement system for schools and other institutions does present barriers to access and additional support is needed in order to fully address those barriers. Schools and institutions continue to absorb changes to the existing regulatory framework. With new nutrition guidelines for school meals beginning in 2012(lunch), 2013 (breakfast) and 2014 (snacks and a la carte), implementing new processes for procurement can seem overwhelming. Many school districts in Washington were unable to attend WSDA purchasing workshops, and are not yet requesting Washington-grown produce, but WSDA continues to receive requests for technical assistance and information regarding best methods for farm to school purchasing. Additional technical

assistance and outreach tailored to schools will continue to address the barriers. Additionally, there is increased interest for technical assistance to support state agencies, childcare/preschool providers, and employee cafeterias. A continued focus on technical assistance, resource development, and workshops is recommended for the institutional sector.

Continuing to offer technical assistance to producers and processors on the contracting guidelines, especially as they relate to correctly using the USDA geographic preference rule will assist buyer/seller relationships to continue to form and grow, and allow school purchasers to identify appropriate sources of these crops to feature in their menus. Increasing school purchasers' proficiency and confidence about buying Washington grown has the potential to significantly grow the demand for a wide variety of specialty crops, including cool season and early season crops that tend to be available fresh during the school year. Continuing to develop, feature and promote recipes using these crops will also assist with market development, as finding Washington grown foods during this season is a challenge that has been consistently recorded in surveys and via technical assistance requests.

Institutional and school markets are growing, but they still have significant potential for growth. Farms and food businesses will be better prepared to fully access this market if they are able to consistently get technical assistance as questions or barriers arise. The 2014 WSDA Farm Survey indicates that 47% of Washington specialty crop growers are interested in school markets generally, and that 40% would be willing to grow crops specific to their needs. Currently only 13% of respondents have sold their farm products into these markets. Resources for farmers and processors developed in this project will be shared widely, in an attempt to help growers and specialty crop processors and distributors better understand the market and how to access it. There continues to be significant potential for expansion in this market and additional workshops, technical assistance and resources would be appropriate to help growers achieve their goals.

Similarly, WSDA's 2014 Survey of Washington Food Processors indicates that only a small percentage are currently selling into institutional (13%) or school markets (8%), though a higher proportion (23% and 24% respectively) are interested in starting or expanding those markets. Shelf-stable and frozen Washington specialty crops are in demand in school and institutional markets, and WSDA has been able to assist both sides of the buyer/seller equation in order to overcome some of the barriers they face. By providing processors with ongoing technical assistance, this small but growing market can offer another access point for Washington farms and food processors. A recently-funded USDA Farm to School Conference and Events grant will support WSDA to bring together supply chain partners to identify potential collaborations between farmers, institutional buyers, processors, food hubs and distributors.

- **Washington's Office of the Superintendent of Public Instruction** advised and presented on the webinar on the school meal pattern, USDA Foods and documentation requirements for foods used in the National School Lunch Program. They also supported and assisted with outreach, scheduling and announcements for the Procurement and Geographic Preference workshops.
- **Walla Walla Public Schools, Arlington School District, and Riverview School District** coordinated and shared their purchasing efforts to learn and make use of WSDA's templates and purchasing recommendations to test them out in their districts and provide feedback.
- **Several Educational Service District offices and local health jurisdiction offices** assisted with our Procurement and Geographic Preference workshops by providing or identifying host locations for the trainings, providing snacks for attendees, and promoting the event to school food service directors and purchasing officers in their local school districts.
- **Washington School Nutrition Association** provided the venue and assisted with promotion for our workshops at their Fall Workshops, and partnered with WSDA on promotion and education about Taste Washington Day to schools around the state.
- **NW Food Processors Association** reviewed and advised on the food processor webinars and shared the announcement via their newsletters and email list to recruit processors to participate.
- **Washington Food & Farming Network** coordinated and hosted the Fresh Food in Schools Summits in 2012 and 2013, providing an opportunity for WSDA to build awareness of the grant-funded work, and to conduct a geographic preference session in 2013. They also conducted outreach and helped plan the networking event in central

Washington, and worked closely with Wenatchee School District on planning and implementation for local food purchases based on WSDA's TA and training.

- **The City of Seattle Human Services Department Youth and Family Empowerment Division** advised and provided resources for development of the Farm to Preschool resources section on WSDA's Farm to School Online Toolkit and is promoting it to childcare providers in Seattle.
- **Oregon Department of Education** presented on Oregon Farm to School in the first Food Processor webinar and attended a Procurement and Geographic Preference workshop to learn ways to share these topics in Oregon. They also coordinated with us to share their Oregon Harvest for Schools posters for adaptation for Washington.
- **Oregon Department of Agriculture** participated in early planning for the food safety webinars and provided Oregon agriculture facts for the webinars.

Three of the "How to Buy and Serve Washington Grown Food in Schools" workshops featured buyer/seller networking and Q & A sessions. WSDA worked with partners to conduct outreach to regional growers interested in school and institutional markets. When WSDA realized that there were meat producers signing up, alternate funds were used to support that portion of the event.

Web-based resources have been developed to support specialty crop growers, and fruits and vegetables are highlighted in the resources. For instance, the USDA school meal pattern also covers dairy and grain products, but the resources developed for food processors all address the fruit and vegetable components of that meal pattern, and other products are discussed only when used to facilitate serving local produce – such as processed products that highlight berries, or yogurt parfaits as a popular way to serve frozen berries.

GOALS AND OUTCOMES ACHIEVED

The activities performed include:

- WSDA's project reached close to 100 nutrition directors, producers and advocates with trainings about ways schools can buy and serve Washington-grown produce. Using 'A School's Guide to Purchasing Washington-Grown Food', the manual WSDA developed through another funding source, workshop participants ran through forecasting templates, and did trouble-shooting exercises around how to write an appropriate Request for Bids using geographic preference, and how to calculate the 'preference'.
- Provision of hard copies and web-based access to "A School's Guide to Purchasing Washington Grown Food" to school nutrition services directors.
- Customizing the Toolkit at www.wafarmtoschool.org to allow users to better search and identify a wide variety of options for food service providers with options that are adapted to the nutrition requirements of meals served in settings from preschool through high school
- Adding 34 new recipes adapted for the requirements of preschools and childcares and 5 recipes for K-12 school meals to Washington-Grown Food Kit in the online Farm to School Toolkit, featuring Washington grown specialty crops
- Sharing and promoting recipes developed by Washington school nutrition professionals that feature and promote the shoulder season and cool weather specialty crops that are available during the majority of the months that schools are in session
- Delivery of institutional market access webinars for processors, and development of technical assistances fact sheets for processors of Washington grown specialty crops. All are shared on the online Farm to School Toolkit.
- Outreach to nutrition professionals, public health representatives, industry groups, and food processors including in-person presentations, trainings, and web-based resources and instruction.
- Pilot project development and implementation in 2 school districts to provide guidance and to demonstrate the appropriate sourcing and contracting for Washington grown and processed specialty crops.

As expressed in the original grant proposal, two years is a short timeline for seeing tangible business results from an education and outreach program. This project focused on buyer education, along with development of targeted resources for farmers and food processors on how to successfully engage with school markets.

There continues to be a need for technical assistance and training in this complex framework of state and federal guidelines and in a market sector that is new to most growers, processors and distributors.

The buyer education side included in-depth contract and regulatory framework trainings. While the WSDA team reached close to 100 buyers and stakeholders through the trainings and workshops, there are school purchasers that for various reasons were unable to attend themselves or to send a staff representative. While WSDA does have a hard copy of “A School’s Guide to Purchasing Washington-Grown Food” reserved for every school district, the guide alone may not suffice to instill purchasers with enough confidence to integrate geographic preference into their regular purchasing procedures. WSDA offered six trainings across the state (the workplan called for four), and would recommend an additional series of at least that number over the coming two years in order to continue to share the knowledge and guidance needed to increase purchaser confidence enough to consistently use geographic preference for school food purchases.

Farms, food processors and other food businesses are better prepared to access and expand operations in the institutional marketplace. However, fully realizing the potential for the market will take more time. WSDA’s database of food businesses expressing interest in institutional markets increased 42% over the period of the grant, from 125 to 217. Of those businesses WSDA confirmed that 69 *successfully made sales* in this market during the project period, and that 37 of those were *new to the market*. Food businesses are interested in diversifying their markets. WSDA surveys indicate enthusiasm for the market that is tempered only by the need for greater clarity about regulatory and customer requirements to access it. Washington’s farm and food businesses are accessing this market in greater numbers now than they were at the start of the project, but there is more work to be done, and technical assistance is a key piece services needed in this growing sector of Washington’s agriculture sector.

The project goals are to:

1. Increase assisted sales for businesses that wish to increase institutional (including schools) sales
2. Increase assisted sales for businesses wishing to enter institutional markets
3. Increase the number of schools using geographic preference in purchasing bids

Planned activity	Activity supports			Comparison of plans to actual accomplishments
	Goal 1	Goal 2	Goal 3	
Identify pilot schools for sample bid specifications and contract language			x	Participating pilot schools provided strategic test cases
Collaborate with partners to plan regulatory workshops			x	Partner collaboration was critical to planning the workshops
Plan processor resource development	x	x		Review of new and existing data informed strategic resource development
Conduct regulatory workshops for school buyers and pilot schools			x	Four were originally planned, and WSDA held six. The workshops provided detailed information and examples to assist schools and their partners in adapting to the challenges of a changing regulatory environment and increase purchases of Washington-grown specialty crops. Three of the workshops included buyer/seller network meetings.

Online toolkit expansion	x	x		Web-based resources are free to download, so do not represent a significant barrier to access this market for new and existing vendors
Plan for regulatory workshops (reflecting pilot projects, legal advisement)			x	Lessons learned during pilot projects and initial workshops informed the strategies used in later workshops
Develop processor resources and education	x	x		Partner organizations and industry groups advised WSDA on the important barriers to market access
Deliver resources and technical assistance for processors	x	x		Webinars reflected lessons learned through other institutions and regional partners including Oregon Dept. of Agriculture and WA Office of the Superintendent of Public Instruction. Fact sheets and informative links posted on www.wafarmtoschool.org .

Goal 1: Increase WSDA Assisted specialty crop sales for businesses wishing to increase institutional sales

Target: 3-5 businesses currently interested in school or institutional markets would increase their sales, OR the number of WSDA’s database of businesses interested in these markets would increase by 10% - **BOTH TARGETS EXCEEDED**

For the target of 10% increase in businesses interested in institutions and/or schools:

Baseline: 125 specialty crop farms or food businesses in WSDA Salesforce database interested in school or institutional markets

Outcome: A 42% increase, adding 92 new businesses for a total of 217 specialty crop farms or food businesses interested in school or institutional markets in Salesforce (compared to the 10% goal)

For the target of 3-5 businesses currently interested in school or institutional markets would increase their sales:

Baseline: 125 specialty crop farms or food businesses in WSDA Salesforce database interested in school or institutional markets. Baseline data captured interest in these markets, but not sales or participation at that time.

Outcome: Of those 125 specialty crop farms and food businesses interested at the beginning of this project, we know that at least 32 have sold to schools during this project. We are not certain that this is an increase over what they may have been doing at the beginning, but it is likely.

Over the period of the project 49% of schools reported an increase in purchases from farms or businesses from which they were already buying Washington-grown produce.

Goal 2: Increase WSDA Assisted specialty crop sales for businesses that are new to school markets

Target: 3-5 businesses would start to work in school or institutional markets – **TARGET EXCEEDED**

Baseline: 131 farms or food businesses in WSDA Salesforce database interested in school or institutional markets. It is unclear whether these had or had not sold to schools at that stage.

Outcome: Thirty-seven businesses new to the farm to school/institution marketplace sold to schools during the project period. Of the 176 farms or food businesses in WSDA’s database interested in schools or

institutional sales at the end of the project, 69 successfully made sales to this market during the project period, including 37 who are new to the marketplace since the beginning of the project period.

Schools reported 123 new local produce vendor relationships established during the grant period.

Goal 3: Increase the number of schools using Washington-grown geographic preference language in their purchasing bids.

Target: 5-10 school districts would use geographic preference language in their bid specifications and contracts – *TARGET EXCEEDED.*

Baseline: USDA's geographic preference option for local agricultural products was authorized by the 2008 Farm Bill, but the final rule for implementation was not published until April of 2011. So when WSDA began the project later that same year there was no data on whether any schools were using geographic preference language in purchasing bids, though the assumption is that none were doing so, other than Kent and Arlington School Districts, which were serving as pilot sites with WSDA as the purchasing guide was being developed. Because the rules around the implementation of the rule were very detailed, nutrition directors were hesitant to attempt to use the rule for fear they would inadvertently use it incorrectly.

Outcomes: Post-project surveys indicate that outreach and education efforts enabled WSDA to exceed the goal of assisting 5-10 districts to use geographic preference. 14 schools indicate that they use geographic preference language, either in informal requests for quotes (11) or formal bid solicitations (3).

Additionally, 27 districts report that they buy locally-grown produce through informal requests for quotes, without a geographic preference. In WSDA's work with districts in pilot projects during this grant period, it became clear that for many districts, particularly those regularly making purchases under \$150,000, this is a very strong method for buying locally-grown food. It is simpler than applying a geographic preference, but works because schools can request quotes exclusively from those farms or businesses providing locally-grown produce, without the need for geographic preference.

Finally, 38 school districts report that they request locally-grown produce through their contracted distributors. This is something WSDA encouraged throughout this project, to build demand for local products through the existing distribution system, and encourage distributors to provide more source-identification for produce they sell to schools, so that schools can highlight and educate students about the farms that grow their fruits and vegetables.

[Note: Some school districts responded Yes to more than one of the above-named methods for buying locally-grown food. Twenty-two districts responded that they do not specifically request locally-grown produce in their food purchases.]

Discussion/Methods:

WSDA found that measuring the change in the number of businesses in the database that are interested in this market was the most accurate way to capture the progress in this market. WSDA began using a web-based Customer Relationship Management database in 2010, and records the markets in which farms and food businesses are interested in participating in order to gauge the trends in the marketplace, and to evaluate the effectiveness of technical assistance at lowering barriers to access and success in the marketplace.

School districts across Washington received a 5-question survey about their purchases of locally-grown foods. 79 of approximately 295 districts responded. Given that this was a short-timeline, small survey, there was not time to follow up

to increase participation rates. School district staff turnover relatively frequently, and many of the emails bounced back due to out-of-date emails. WSDA staff did not have capacity to respond in more detail.

Summary:

Percentage of schools reporting increased purchases of Washington-grown produce - 49% (of 79 respondents)

Percentage change in WSDA’s database of food businesses interested in the marketplace - 42%

Number of new food businesses added to the database - 92

Number of new food businesses in database working as vendors to school districts - 37

BENEFICIARIES

Washington growers of fruits and vegetables are clear beneficiaries – institutional purchasers are better prepared and more confident about purchasing Washington-grown produce for their meal programs. Those same buyers are increasing demand by requesting locally-grown produce from their distributors, and increasing their purchases direct from farms.

Washington specialty crop growers and processors have more information about institutional markets, to assist them in meeting their goals of increasing or starting sales to schools and other institutions, through WSDA webinars, fact sheets, presentations and sample school purchasing documents. These will continue to be available to those businesses on the WSDA Farm to School Toolkit and to be shared at future workshops and conferences.

Institutional food service professionals have a wider variety of recipes available that feature Washington-grown fruits and vegetables and are adapted to the nutrition standards required in a variety of settings. Preschool through high school, recipes featuring Washington-grown fruits and vegetables (and especially those featuring cool season crops) enable food service providers to consistently serve healthy, Washington grown foods that are part of good nutrition, and support the regional agriculture economy.

Washington youth who are enrolled in pre-school programs, and through high school programs, are seeing more and greater variety of Washington grown foods in regular meal service, and through special events such as the annual Taste Washington Day event, which WSDA promotes with partner agencies around the state. This year First Lady Trudi Inslee accompanied WSDA Director “Bud” Hover to a Taste Washington Day celebration in Wenatchee.

- Producers of Washington-grown fruits and vegetables benefited from the development new purchasing relationships with schools. The end of project survey to nutrition directors asked how many new Washington-grown fruit and vegetable purchasing relationships with farms or food businesses they established during the project period. In total schools indicate 123 new purchasing relationships made with fruit and vegetable producers and processors.
- 69 farms or food businesses participated in the project and successfully did business with schools. And of those 69 businesses 37 were new to the market.
- WSDA added 92 new businesses to the database of farms and food businesses interested in institutional and school markets. This is a 42% increase in businesses pursuing this market.
- Nutrition directors are better able to understand and implement geographic preference language into their purchasing bids. As a result they were able to initiate new relationships with vendors of Washington-grown fruits and vegetables.
- Three school districts are using geographic preference language in formal purchasing bids (formal usually used for purchases over \$150,000), and eleven districts report using geographic preference language in their informal purchasing bids (purchases under \$150,000).
- 61% of school districts shared that they plan to either keep their Farm to School efforts at a consistent level, or increase their Farm to School work.
- WSDA’s biennial statewide school survey indicates that 85% of nutrition directors see seasonality constraints as a barrier to featuring Washington-grown. With new preschool and school-age recipes featured and promoted through the Washington-Grown Food Toolkit, many of which feature early and cool-season crops, school nutrition professionals have better and more varied options for serving Washington-grown fruits and vegetables in meal programs.

- Washington’s Healthiest Next Generation seeks to improve children’s health, in part by targeting pre-school environments with nutrition education and better access to fruits and vegetables so that snacks and meals are more nutritious. The Farm to Preschool toolkit’s resources will assist with this important statewide initiative by sharing Washington-grown seasonality guides and pre-school/child care-specific menus developed to incorporate Washington grown fresh and processed foods.

LESSONS LEARNED

This work depends on successful engagement of school food service partners, since they are the active buyers and decision-makers in the demand side of farm to school. This is challenging, because school food service directors are generally overworked and understaffed, and are constantly reacting and responding to new regulations and standards. WSDA’s awareness of this was reinforced in this project.

Participation in procurement workshops was less than anticipated, and it proved challenging to find committed partners for procurement pilot projects. WSDA did work on a more sporadic basis with multiple districts that are now using the procurement methods that were being piloted, so overall WSDA did meet the goal of learning and testing procurement methods and how they work in schools. Overall, the lesson is that flexibility and understanding are critical when working with school districts, recognizing that they have competing demands on their time, focus and energy.

Another lesson is that it will take time to develop relationships and an audience in the food processor community. Despite contacting WSDA-licensed businesses directly by email and sending the notice out through NW Food Processors Association, turnout was low on the food processor webinars (fewer than 10 per webinar), but WSDA plans to continue reaching out to these businesses, and has provided the webinars and other resources on the WSDA Farm to School Toolkit so that they will continue to be used by businesses over time.

Despite these challenges, schools and growers continue to seek out WSDA services to support them in meeting their farm to school goals.

WSDA’s publication, *A School’s Guide to Purchasing Washington-Grown Food*, has been recognized nationally as a key resource in understanding local purchasing and geographic preference in school food. USDA has adapted portions and templates from the guide for use in their national training webinar and materials, and is currently finalizing a local procurement guide for use around the country. WSDA was invited to review and discuss the USDA materials and draft guide, providing for increased understanding of the national rules and practices relating to local food purchasing. This is invaluable experience for WSDA staff as they conduct training and technical assistance in Washington State.

All activities, goals and Expected Measurable Outcomes were achieved.

CONTACT PERSON

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ADDITIONAL INFORMATION

This project did not propose or track in-kind or cash matching donations. WSDA did provide in-kind resources in the form of supplying goods and services such as office space, motor pool vehicle use, phones and computers for the duration of the project.

All are included by links in the report text.

PROJECT #10

Project Title: Improving Access and Effectiveness of Seattle Farmers Markets

Partner Organization: Neighborhood Farmers Market Alliance (NFMA)

PROJECT SUMMARY

The Seattle Neighborhood Farmers Markets (NFM) provide the majority of over 100 farmers' annual income. NFM provide the largest source of farm-direct Washington produced food in Seattle. In order to ensure markets continue to grow and thrive, they must expand the shopper base and increase farm sales, which they did by producing on-site specialty crop events and reaching out to low income shoppers. These two areas of focus allowed them to reach out to new customers in effective ways, educate consumers about specialty crops once they've arrived at the markets, and increase food access in lower income communities. The goal was to increase sales by \$350,000 (5%) annually with continuing gains into the future.

In 2009-2011, the Farmers Markets in Seattle lost ground and saw sales slow and even decline. In order for farms to stay in business, the markets needed to find ways to increase sales beyond grassroots marketing campaigns. Shopper surveys determined that education about seasonally available crops and prices were key issues. Special events and low income incentive programs address both of those issues.

This project was not built on a previously funded SCBGP project.

PROJECT APPROACH

A. Market Events

The Neighborhood Farmers Markets planned and produced around 20 specialty-crop focused on site events throughout different growing seasons and in seven different neighborhoods. All market events but two (both that had inclement weather) met the goal of increasing shopper counts by 10% on event days, and increasing sales to farmers by 5%. The greatest successes were found in events outside of the peak season, when shoppers might not otherwise be engaged with the markets, and when the emphasis was on using specialty crops in a unique way. For example, the early spring Rhubarb Fest in Columbia City invited shoppers and local businesses to submit savory and sweet recipes and showed the myriad ways rhubarb can be used. Another popular event was a fermentation demonstration in late winter, which showcased how to ferment cabbage into sauerkraut and kim chi.

Overall, specialty crop-focused market events contributed \$95,724 in a day of market sales and an increase of 9986 shoppers. (This was calculated by comparing and averaging the sales change year over year and week over week.) Market total gross sales grew 8% in both 2012 and 2013, and 17% over both years.

B. Low Income Outreach

There was \$5,000 annually set aside in "Market Bucks" as well as staff time to provide an opportunity for a low income shoppers to purchase fresh fruits and vegetables. They received an additional grant to do a wider-scale pilot in 2012—5 months of \$10 incentives for EBT shoppers at 4 markets. The WSDA Specialty crop funding allowed NFM to include the other 3 markets in the pilot so there was a system-wide program in place for the latter half of the season. "Market Bucks" became "Fresh Bucks" and were limited to fresh fruits and vegetables only, which gave low income families more fresh produce, drove farm sales, and naturally limited their use to specialty crops.

The WSDA funding brought Fresh Bucks to 3 Seattle neighborhoods: Phinney, Magnolia, and West Seattle in 2012. In 2013, the program went citywide, and the WSDA specialty crop dollars were used to fund the 15% of the Fresh Bucks value not covered by the public and private funding already available.

SNAP usage grew 60% during the 2 years of the Fresh Bucks program, increasing sales to farmers to over \$115,000 in annual SNAP sales and \$93,772 in Fresh Bucks redeemed to specialty crop farmers.

SNAP incentive programs are an important way to increase real and perceived food access, generate farm sales both through increased SNAP usage and the incentive dollars, and strengthen farmers markets.

As always, the key partners in everything they do are their farm vendors, who harvest the crops they showcase, donate to the demos where they educate consumers, contribute recipes, and vie for the title of best apple. They also have meaningful partnership with organizations and business associations who host their markets, including: Phinney Neighborhood Association, West Seattle Junction Association, Columbia City Business Association, the Capitol Hill Chamber, and the Lake City Library. Each contributes through marketing the markets and events, providing free or low-cost space for the markets to stage, and integrating the markets with neighborhood-wide special events.

The NFMA received support for 2013's Fresh Bucks SNAP incentive program—now citywide— from the Washington State Farmers Market Association and the City of Seattle Office of Sustainability and Environment, as well as the mayor's office. The other funders for the Fresh Bucks program are the Chase Foundation and the Seattle Foundation.

The Neighborhood Farmers Markets provided a staff and cash matches to ensure that non-specialty crop products didn't benefit from a particular event or endeavor.

GOALS AND OUTCOMES ACHIEVED

A. Market Events

Columbia City Farmers Market 2012-2013 Special Event Days: Rhubarb Fest (5/16/12 and 5/22/13), Berry Spectacular (7/25/12) and Cherry Tasting and Varieties Guide (7/3/13). Shopper Counts were up 16% - 77%, and sales raised 4% - 48%. The market ended with Vendor Sales up 6% overall. The "shoulder" season event, Rhubarb Fest, did far better to draw in shoppers than an event in peak season when crowds are already shopping the markets. Rhubarb Fest was also a new and novel concept that attracted foodies and newbies alike. The market gross sales grew 11% from 2011 to 2013, \$78,578 in sales.

Lake City Farmers Market 2012-2013 Special Event Days: Glorious Greens (6/28/12), Apple Days (9/13/12), Zucchini Races (8/22/13), and Apple Days (9/12/13). Shopper counts were up 20% - 68% and sales raised 8% - 28%. The earlier, newer event again fared better as shoppers were introduced to the breadth of greens available at the market. The second year's Apple Days also benefited from recognition and a wider variety of activities. Vendor Sales were up 7% on average, though the season's gross sales were flat.

Magnolia Farmers Market 2012-2013 Special Event Days: Zucchini Races (8/25/12) and Strawberry Celebration (7/13/13). This market was much bigger in 2012 and in a new location, so shopper counts were already up 150-200%. On Zucchini race day, they rose to 221%, with sales up 14% from the week before and up 37% from last season. Vendor Sales were up 12% on average at the end of the season. In 2013, the market continued to gain ground with 28% more shoppers and a 20% increase in sales on the special event day. Market sales grew 66% from 2011 to 2013.

University District Farmers Market 2012-2013 Special Event Days: Ready, Set, Go, Cook! (8/11/12). This event is conducted in partnership with the local food bank, so it isn't strictly specialty crop focused, and the grant did not fully fund the event. Shopper counts were up 9% from the year before and 16% from the week before. Sales also rose proportionately. In Fall 2012 and Spring 2013, there were more "off-season" events: Appleloozza (10/20/12), Fermentation Demo (3/16/2013), and Juicing and Fruit Syrups (5/11/13). Shopper counts were up 25% on average on special events days, and sales rose between 8% & 42%. The market was up 18% from 2011.

Phinney Farmers Market 2012-2013 Special Event Days: Glorious Greens (7/6/12), Phruit Phest (8/10/12). Glorious Greens brought in 47% more people than the same time last year, and 77% more than the previous weeks. Those shoppers translated into 11% better sales than the previous year and 44% better than the weeks previous. As was true in the other events, the Phruit Phest later in the season showed less favorable results. In 2013, the Preserving Berries and Apricots Event (6/28/14) grew shopper by 30% and sales by 36% from the year before. The market was down overall.

B. Low Income Outreach

B.) SNAP Usage: The goal was to increase SNAP usage by 20%. At the particular markets that received WSDA funds, the totals are as follows:

October, 2013 – September, 2013 Fresh Bucks

	2012	Fresh Bucks Distributed 10/1-12/31	Transactions	New SNAP Users	Change in SNAP use 2011-2012
West Seattle	\$	1,490	160	32	30%
					Change in SNAP use 2012-2013
	2013	Fresh Bucks Distributed 7/1-9/30	Transactions	New SNAP Users	
Phinney		2008	200	34	59%
Magnolia		512	54	5	50%
West Seattle		2164	235	22	54%
	\$	4,684	489	61	
Total 10/1/12-9/30/13	\$	6,174	649	93	

System-wide, SNAP was up over \$26,000 during the reporting period, or 29%, which surpassed the target of 20% SNAP growth. Fresh Bucks distributed in 2013 totaled \$53,608, which are all specialty crop sales.

Overall sales to vendors increased by 17% from 2011 to 2013, surpassing the overall target of 5% increase in sales, providing more than \$700,000 in additional sales to specialty crop farmers. While this is not all attributable to specialty crop events and low income outreach, those efforts certainly met their goals of increasing their shopper base and contributing towards sales growth.

The activities and goals matched (and exceeded) the actual accomplishments:

	Benchmark			Result		% Change '11-'13	\$ Change '11-'13
	2011	2012	% Change '11-'12	2013	% Change '12-'13		
Gross Vendor Sales	\$ 6,916,317	\$ 7,519,190	9%	\$ 8,105,256	8%	17%	\$ 1,188,939
Shopper Counts	338,146	380,382	12%	438,118	15%	30%	\$ 99,972
SNAP Usage	\$ 72,089	\$ 96,933	34%	\$ 115,580	19%	60%	\$ 43,491
Estimated Specialty Crop Sales (60% of Total Sales)	\$ 4,149,790	\$ 4,511,514		\$ 4,863,154		17%	\$ 713,363

The special events were quantified by comparing last year’s sales at that market around the same time and week to week market sales leading up to the event. These were then averaged to get a baseline from which to measure the increase.

Specialty Crop Sales are conservatively estimated based on historic percent of total sales, averaged across markets, 60%. Total impact to specialty crop farmers is at least \$713,363 over the 2 years of the grant.

BENEFICIARIES

The beneficiaries of this project are the specialty crop farmers in the NFMA system, of which there are 79 or 91% of the farmers in the system. Each of these projects was focused on increasing sales to farmers, and they did, far beyond the goals of the project.

Secondary beneficiaries are those shoppers who benefitted from family-friends, education events at the markets, and those low income families who were able to increase they fruit and vegetable intake. All of these shopper benefits continue to have ripple effects after the close of the project as they continue shopping at Farmers Markets.

The NFMA collects daily gross sales totals from all vendors each market day to get both the baseline and to measure growth. Specialty crop farmers as a subset are estimated to be at least 60% of total gross sales, accounting for changes in seasons and across markets.

The quantitative data is all listed above.

LESSONS LEARNED

There is benefit both to doing new events at different times of year (a fermentation demonstration in early March), and also keeping certain tried-and-true events (Apple Celebrations in the early fall).

The implementation of a SNAP incentive program focused on fresh fruits and vegetables may have shifted the balance of sales at the markets (but there’s no exact data to benchmark this). SNAP growth slowed somewhat as shoppers used more incentive dollars and fewer of their own SNAP dollars to shop with. This has an advantage for specialty crop farmers.

CONTACT PERSON

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ADDITIONAL INFORMATION

	Total Grant	Total Cash/ In-Kind Match
Line Items		
SALARIES/ WAGES BENEFITS	\$45,987	\$29,075
	\$6,893	\$2,808
TRAVEL EQUIPMENT SUPPLIES	\$6,739	\$4000 \$4000
CONTRACTUAL other (Market/ Fresh Bucks)	\$10,000	\$12,000

TOTAL

\$69,619

\$51,883

Cash Match (\$16,000)

- The NFMA paid 70% of fire and health department permits associated with special events, since they are used occasionally for non-specialty crop events, and for farmers utilizing propane heat during the winter months.
- The NFMA planned to provide a 50% cash match for Market Bucks to ensure that WSDA grant funding would redeem vouchers used to purchase specialty crops only, but instead created Fresh Bucks that were limited to fresh fruit and vegetable products only. However, there were significant additional program costs including materials production and printing, outreach, evaluation, and expansion of the program that were funded by the NFMA through a grant from the City of Seattle and its private funders. The scope of that program is quite large, and since this grant was not meant to be that expansive, the reported match will remain as budgeted, at \$12,000.

In-Kind Match (\$35,883)

- Salaries, Wages, and Benefits: The NFMA has provided a 50% match in salaries and benefits for all staff time related to the event production and low income outreach, to ensure that non-specialty crop farmers don't benefit from WSDA funds.
- Equipment: The NFMA has already invested in tents, cook tops, and other equipment related to on-site cooking demonstrations and special events.

PROJECT #11

Project Title: Enhancing tree fruit IPM decision making

Partner Organization: Washington State University (WSU)

PROJECT SUMMARY

Integrated pest and disease management in tree fruits requires a broad knowledge of pest and natural enemy phenology and how different management options affect pests and natural enemies. The online WSU-Decision Aid System (DAS) provides stakeholders with this necessary, but complex and time-sensitive, information to help guide the decision-making process for effective pest control. With the help of previously conducted surveys of DAS users, the DAS team identified needs for increased streamlining of the information transfer and expanded functionality of DAS to improve the decision-making process. Many Hispanic growers and pest managers expressed interest in our surveys in using DAS, they also indicated that they need assistance and training to best use the system. In addressing these needs, our goals were (1) to facilitate the IPM decision-making process by improving the DAS spray guide (WSU pesticide recommendations) and implementing new features that allow entry of orchard-specific user data as well as pushing alerts triggered by pest model events; (2) to increase the access to DAS by mobile device users by making DAS compatible with more mobile platforms; and (3) to expand the use of DAS among Hispanic growers and pest managers.

This project was largely motivated by repeated feedback of DAS users (2010 survey and personal communications) to provide more Integrated Pest Management (IPM) specific information, by the users' unawareness or criticism of certain features, and requests to make DAS accessible on mobile devices other than iPhone. DAS is used by over 300 users (growers, orchard managers and pest management consultants alike) who frequently access the system between March and October. The DAS users are major tree fruit industry players, growers and consultants, who collectively manage or make recommendations for virtually the entire tree fruit acreage in Washington State. DAS users estimate the value of DAS to the industry to be \approx \$70/acre for a total value of \$12.7M/year on orchards where DAS is currently being used. The WA tree fruit industry has come to rely heavily on DAS seeking information on optimal pest control treatment timing, general information on IPM, and pesticide options that are effective against pests as well as harmless to natural enemies in orchards.

PROJECT APPROACH

The first step before work on all goals could be initiated was to upgrade the framework of DAS to make the webpage compatible with the latest web browser standards regarding programming language (HTML, PHP, and JavaScript). This upgrade resulted in all DAS modules (e.g. spray guide, help center with video tutorials, model output, etc.) working noticeably faster and independently, so when one module does not respond properly the other features of DAS will keep functioning. Another major change in the user interface of DAS was to present a "flat" webpage vs. the many pop-up windows currently implemented. The new DAS 5.0 was launched in spring 2013.

Goal 1: Facilitate the IPM decision-making process.

The ***new spray guide design*** was developed and implemented into DAS in March 2013 to help users choose pesticides for efficacy and minimal non-target impacts. A brief survey of our DAS beta-user group in February 2012 about the DAS spray guide's usefulness yielded suggestions for minor layout changes that have been incorporated. In the new DAS upgrade, users get direct access to the spray guide through the main navigation menu on top of the web page (without needing to go through the model output first), even when they are not logged in. This allows users to access information faster. The new spray guide layout displays recommended pesticide options as cards initially showing only the efficacy on other pests and the effects on natural enemies. These cards can be sorted by pesticide efficacy and natural enemy effects. Users can select pesticide cards of interest for a more detailed comparison where all pesticide information is displayed. In addition, filter functions were created that augment comparisons between pesticides for efficacy and non-target impacts.

The DAS user survey conducted in 2013/2014 indicated that 234 out of 332 survey respondents used the new spray guide filters; 44 respondents said they did not need or want to use them, while 54 were not aware of this feature. The internal DAS tracking system counted more than a 1,600 uses (clicks) of the efficacy filter in 2013-2014. The updated help video on how to use the new spray guide was watched 37 times in 2013-2014.

Out of 324 respondents 240 indicated that they used the upgraded spray guide with 71% finding it useful and 59% saying it is easy or very easy to use. The majority of respondents indicated that the upgraded pesticide effects and added maximum residue level information were useful (64% and 61%, respectively).

The proportion of users that DAS helps to a “very great extent” in choosing pesticides for best efficacy rose from 15% (15 respondents) in the 2010 survey to 26% (60 respondents) in 2013/2014. The proportion of users that say DAS helps to a “very great extent” in choosing pesticides to reduce natural enemy mortality rose from 11% (11 respondents) in 2010 to 28% (66 respondents) in 2013/2014.

The *orchard management system* (OMS) was designed to allow users to define multiple orchards and orchard blocks. To this point, users can then enter and view orchard-specific information, such as trap locations, trap catch and notes, from their mobile device with Internet access. This information is integrated into Google Maps, which means a location, for example for a trap, within an orchard can be defined and saved (using longitude and latitude), labeled and time-stamped. This creates a log to store information about which pest was trapped, how many pest insects were caught and when. The OMS is currently in alpha testing (by the developer team). Completion, beta testing with the DAS beta-user group, implementation, and user surveys on usefulness and satisfaction will be carried out after this project ends. Sampling notes and pesticide use as well as desktop and offline access of the data are additional OMS functions that were planned but could not be finished during this project. These features will be completed in the near future.

The *push-notifications* system alerts DAS users when critical pest events happen in order to optimize pest control timing. The user interface for this system as well as the operational functions are built on the DAS development site and are being alpha tested (by the developer team). The push-notification settings are accessible through the user’s account where the user can select, for each model separately, what kind of messages to receive and in which format (on the website or via email; text messaging is being considered for future updates if requested by users). Alert events had to be determined and messages created for all models. Automation of model computations for all user-selected WSU AgWeatherNet stations and memory routines for pushed events had to be fine-tuned so that it would not slow or crash other DAS features and functions. This presented some challenges and has delayed the release of this feature until spring 2015.

Goal 2: Increase access to DAS by mobile Internet device users.

The framework upgrade of DAS automatically enabled access from mobile devices that run on the operating systems iOS 4 and Android 2.3 or higher. The entire DAS website works nearly flawlessly, except for minor errors caused by the default browser on Android 2.3 or due to slow Internet access.

Currently, there are 832 DAS accounts with a minimum of 1 login in 2014; 625 DAS users logged in 3+ times, while 381 users logged in 10+ times. The survey results from our 2013/2014 user survey show that 265 respondents have experience with smartphones or PDAs, while 161 respondents actually use DAS on their mobile devices, with 141 using DAS on their smartphone and 77 on their tablet computer. Google Analytics for the DAS website shows that, between January 1 and September 30, 337 and 169 users accessed DAS with their mobile device and tablet, respectively. These numbers suggest that our set target of 175 mobile users was reached. Google Analytics indicates that the majority of users view DAS on their iPhone (211) or iPad (157).

Goal 3: Expand the use of DAS among Hispanic growers and managers.

This team promoted the benefits of using DAS among Washington State growers, pest managers and consultants, with an emphasis on Hispanic stakeholders, in 17 presentations (15-60 minutes long) reaching approximately 2,000 attendees of various events, including WSDA pesticide applicator trainings, Wenatchee Valley College’s Hispanic Orchard Employee Education Program classes, company trainings, grower meetings and Washington State Horticultural Association annual meeting. As our DAS outreach was piggybacked on tightly scheduled recertification classes with Hispanic growers and

pest managers in order to reach more potential users, long hands-on workshop activities were not possible there. In addition, nine 2-hour long hands-on workshops were held in small groups (74 participants total) to allow attendees to set up a DAS account and practice navigating through all website features, utilizing our DAS mobile computer lab or their own laptops. The presentations and workshops were held in Spanish and/or English.

As part of our efforts to make DAS more available to Hispanic users, the entire Spanish DAS website was reviewed and edited by native Spanish speakers with horticulture and pest management expertise. These revisions were necessary so that only common and proper terminology with the local Hispanic growers and pest managers is used. In addition, all current help video scripts have been translated. The Spanish captions and narration still need to be incorporated into the videos.

As a result of the presentations and workshops, new DAS accounts were set up (539 between 2012-2014, 32 of them using the Spanish site). Of these newly signed up users, 119 have used DAS actively in 2014 (10+ logins), while 6 of those users have set their language preferences to Spanish. In the most recent DAS user survey, 36 respondents (9.8%) specified that their first language is Spanish (7 declined to answer). This number is roughly a third of the initial target of 100 Hispanic users (later revised down to 50). It also indicates that most of the identified Hispanic DAS users still use the English site.

V.P. Jones, PI – DAS Director: Dr. Jones oversaw the project, reviewed project activities, timelines, budget and reports, and provided conceptual guidance for feature development.

J.F. Brunner, PI: Dr. Brunner oversaw the project, reviewed project activities, timelines, budget and reports.

U. Chambers, Co-PI – DAS Manager/Educator: Dr. Chambers oversaw the project, coordinated all project activities and timelines, and prepared the project reports. She developed and analyzed the user surveys; she developed concepts for new or updated DAS features together with the DAS programmers and Dr. Jones. Dr. Chambers planned and conducted workshops and outreach as well as presented DAS at grower meetings. She prepared all video tutorials and help manual sections, and coordinated interactions with the DAS beta user group.

N. Lehrer, Sociology and Spanish Outreach: Dr. Lehrer contributed to this project during the first year (before she moved to a different job). She planned and conducted workshops and outreach as well as presented DAS at several grower meetings.

B. Petit – DAS Programmer: Mr. Petit built and upgraded the DAS website. He developed and implemented the new spray guide and has developed and tested the new notification system. Mr. Petit provided technical assistance during the survey implementation and integrated help videos and manual sections into the website.

C. Jackson – DAS Programmer: Mr. Jackson was hired as second DAS programmer in fall 2013. He has been working on the new orchard management system since January 2014. He built the database as well as the mobile web app for the OMS.

DAS beta user group: This group of pest managers and advisors reviewed and provided feedback for new DAS features, such as the re-designed spray guide. This group's help will be needed for testing and commenting on the remaining new features that haven't been completed yet.

This project solely benefits the tree fruit industry.

GOALS AND OUTCOMES ACHIEVED

Goal 1: Facilitate the IPM decision-making process.

The WSU Spray Guide on DAS was redesigned and improved to facilitate pesticide choice based on efficacy and low side effects on natural enemies. The new design allows users to compare all recommended pesticides (for a particular crop, target pest, and time of the year) with regards to pesticide efficacy and non-target effects. This tool is now more easily accessible and more useful. Consequently, it has been accessed by more users and more frequently. Users have been using the improved filters in the spray guide more often than before, when most users had not been aware of those features. Surveyed DAS users responded that they find the spray guide improvements useful and the percentage of users finding the pesticide efficacy and side effects information helpful has increased.

Goal 2: Increase access to DAS by mobile Internet device users.

The DAS website was upgraded and made accessible on all major mobile platforms (iOS 4+ and Android 2.3+). As a result, more users are now able to view the full information available on DAS using their mobile Internet devices, which shows in the increased number of DAS users accessing DAS with their smartphones and/or tablets.

Goal 3: Expand the use of DAS among Hispanic growers and managers.

The benefits of using DAS were intensively promoted at events organized for mainly Hispanic growers, orchard managers, field staff, in particular during the first year when our bilingual outreach expert was still participating in this project.

Although not all goals were achieved during the timeframe of this project, the progress that has been made laid the foundation for the ongoing expansion and improvement of DAS. The DAS team intends to complete the tasks that were set out to do within the next year with other funding sources, namely the notifications and orchard management system. These are features that users have requested and that would benefit the users by better informing their pest management decisions. The OMS would also benefit the tree fruit industry as a whole as researchers could use anonymous observational pest/natural enemy data and pesticide input data to verify pest models or impacts on occurrence of pests or natural enemy populations.

A long-term goal associated with the implementation of the orchard management system is that users (65 users estimated as target) would increase their spatially targeted pest management. The idea behind this is that when pest management decision makers have a better understanding of where in their orchards pests aggregate (which is typical for some insect pests), then control treatments could be limited to those areas without jeopardizing fruit quality. This would save costs and pesticide input into the environment. The pest trapping and sampling feature of the orchard management system will allow users to enter, view, and share pest numbers so that they can more easily keep track of pest phenology and have better visual representation in maps and graphs of spatial and temporal changes in pest numbers. Impacts on spatially targeted pest management activities will be measured through future DAS user surveys.

Established activities

Goal 1: Facilitate the IPM decision-making process.

- Re-design WSU Spray Guide on DAS, evaluate in DAS beta-user group, release. Create help files (video tutorial & online manual). Survey users about this feature.
Target: 130 users will use this upgraded feature.
- Develop orchard monitoring system (OMS), evaluate in DAS beta-user group, incorporate changes, release in English and Spanish. Create help files (video tutorial & online manual). Survey users about this feature.
Target: 130 users using this feature. 50% of them increase their spatially targeted management.
- Develop and implement push-notifications for alerts of critical pest events, evaluate in beta-user group, incorporate changes and release. Create help files (video tutorial & online manual). Survey users about this feature.
Target: 100 users subscribed to this feature.

Actual accomplishments

- Activity completed. Target exceeded. 234 out of 332 surveyed DAS users have used the new spray guide; 71% find it useful. The percentage of users considering non-target effects of pesticides while choosing pesticides increased from 11% (2010) to 28% (2014).
- Mobile trap catch module of OMS developed and in alpha testing. Beta testing delayed until December 2014. Activities in progress, but not completed: desktop and offline version of OMS; sampling feature. Activities still due: develop pesticide input feature; help files; user survey. Target could not be reached due to postponed release.
- Push-notifications developed and in alpha-testing. User survey questionnaire created. Beta testing and implementation delayed until March 2015. Target could not be reached due to postponed release.

Goal 2: Increase access to DAS by mobile Internet device users.

- Expand DAS versions for mobile devices. Survey users. Monitor DAS use.
Target: 175 smartphone/tablet users;
 DAS accessible on iPhone, iPad, iPod Touch, Android, Blackberry;
 More features available on mobile devices.

Activity completed. Target reached.
 265 users have experience with smartphones or PDAs; 161 users say they use DAS on mobile devices (141 on smartphone, 77 on tablets). Google Analytics reports 506 unique users accessing DAS from their (multiple?) mobile devices including tablets in 2014.
 Complete DAS web content available on mobile devices, but slow loading when slow Internet connection.

Goal 3: *Expand the use of DAS among Hispanic growers and managers.*

- Develop and deliver DAS training workshops (in Spanish and English); translate new features into Spanish. Translate new help files into Spanish.
Target: 100 Hispanic users. Later revised to 50.
 15 workshops per year (45)
 4 grower meetings per year (12)

Targets were partially achieved.
 32 new signups that set language to Spanish, but only 6 active users retained (most Hispanic users appear to prefer the English site).
 9 workshops (74 participants)
 17 presentations (~2,000 attendees)
 Translations pending.

Goal 1: *Facilitate the IPM decision-making process.*

The new **DAS spray guide** filters are used by 234 (70%) of the surveyed users, as indicated in the recent 2013/2014 DAS user survey. Our baseline was 80 users (55%) using the spray filters according to the 2010 DAS user survey. The target set for this project of a total of 130 users using the spray guide filters was exceeded. Moreover, not only did more users filter spray guide results more frequently (>1,600 hits), but they also report this feature to be useful (71%) and easy to use (59%). As a result, the DAS spray guide helped more users to a “very great extend” in choosing pesticides with respect to efficacy and side effects (26-28%) than before in 2010 (11-15%).

Goal 2: *Increase access to DAS by mobile Internet device users.*

Before the start of this project, a mobile version of DAS only existed for iPhones and only 18 (12%) survey respondents said they access DAS mobile in 2010. That previous mobile version was very limited compared to the desktop version. The goal to expand mobile access of DAS and provide access to all DAS desktop features across all platforms (iOS 4+, Android 2.3+, etc.) was accomplished. The anticipated target was a minimum of 175 mobile users by the end of this project. Depending on the statistics considered, the target was nearly reached or exceeded. The most recent user survey indicates that 161 (46%) respondents access DAS on their smartphones and/or tablets, while Google Analytics reports 506 unique mobile device and tablet users in 2014. Our survey may underestimate the actual numbers as only very active users responded. In fact, the DAS team recently found multiple users using the same account (e.g., >30 used a single account and at least 10 such accounts were identified). Google Analytics, on the other hand, may give an overestimate as some users may have multiple mobile devices.

Goal 3: *Expand the use of DAS among Hispanic growers and managers.*

Prior to the start of this project, there were 5 users who viewed DAS in Spanish. Our initial target was to attract 100 Hispanic growers and pest managers to use DAS. As user numbers did not increase as expected, the initial target was revised downward to 50 Hispanic users. During this project, 539 new accounts were set up, of which 32 users have set their language preference to Spanish according to user account information. Only 6 users on the Spanish DAS view the site frequently (10+ times per year). The recent survey results suggest that most users who identified as speaking Spanish as their first language (36 in total) use the English DAS site. Although this team certainly increased awareness of the availability and benefits of DAS among the Hispanic tree fruit community with workshops and presentations, the target was not achieved.

BENEFICIARIES

The primary direct beneficiaries of this project are Washington's growers, pest managers, and pest management consultants who produce tree fruits on or make recommendations for 218,000 bearing acres on 3,000 orchards. DAS user surveys repeatedly show that DAS is used on virtually the entire tree fruit acreage in Washington State.

The most recent DAS survey shows that DAS is used on 247,000 acres and 3,350 orchards. This includes duplicates where several users refer to the same orchards that they own or make recommendations for. The most current estimate of Washington State tree fruit acres is 218,400 acres. The users estimate DAS' current value to be on average \$70.44/acre or \$15.4M for the entire tree fruit industry. DAS' economic impact has increased since 2010 when its value was estimated as \$12.7M across >182,000 acres and 2,900 orchards.

More decision makers have been helped with improved recommendation display and filters in the new DAS spray guide (increase from 55% to 70% of DAS users or about double from 11/15% to 26-28%). The number of users accessing DAS on their mobile devices has increased by nearly 10-fold.

LESSONS LEARNED

Upgrading the DAS framework to make it compatible with the latest web browser standards was a crucial, but major and very time-consuming, activity. It meant that the complete DAS program had to be re-written from the ground up while our programmer had to learn the new standards along the process. The benefit of this upgrade was that it automatically made the DAS website compatible with mobile platforms. However, it still required more time than expected.

During our workshop activities with Hispanic growers and orchard workers, the DAS team learned that not all participants readily have access to computers and the Internet. Many participants had no email address or were not proficient in using computers. Some brought their children to learn to navigate the website. In addition, many workshop and presentation attendees may not be in a position where they can make pest management decisions for the orchards they work for, thus are in a need to use DAS. First-language Spanish speakers who are in positions where they make decisions regarding orchard management are fluent in English and use the English DAS site. Also, working with the Hispanic community needs a lot more hands-on interaction and outreach formats, and even different times (e.g. after 5pm) to accommodate their schedules. Ultimately, a fluent interpreter with a background in horticulture/ entomology and collaboration with local extension personnel is crucial for success.

The project increased the use of DAS (as expected), but it also generated enough interest for the WSU College of Agriculture and Human and Natural Resources to set up a decision support system initiative that will expand to cover other cropping systems and to share resources developed in this program. The College also agreed to cover the cost of one of our programmers (starting this last year) which will allow us to complete the parts of the grant that were not fully finished.

One lesson learned is that web design and programming can meet unexpected challenges and take more time than anticipated. While some of the delays are a result of dealing with issues required for greater reliability and updates needed to meet evolving web standards, a considerable amount of time had to be spent dealing with problems associated with external data sources. For example, a series of problems alerted the DAS team to develop a completely new set of error checking routines to process environmental data used to run the models on DAS. When DAS' weather data source had issues caused by a server crash, it also crashed DAS because it kept providing corrupted data, whereas if it had just stayed down, DAS would have worked smoothly. This required error-checking routines that were more robust and that insure if a data source provides corrupt information that source is not used until it passes DAS' quality check.

Hiring new staff to work on project activities can cause delays as our system is quite large and complicated from a programming perspective and new staff members need time to acquire familiarity with the system and any specific skills or insights to make efficient and timely progress. Also, staff leaving the project can slow progress for respective objectives, so alternative strategies need to be put in place and outcomes adjusted accordingly.

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ADDITIONAL INFORMATION – See Attachment D 12-25-B-1262

The final total cost share amount was \$136,801.11, which included Ute Chambers' 21.25% salary plus benefits for Year 1 only and F&A (Year 1) plus unrecovered F&A (Y1-Y3). The matching funds were used to help provide support for Ute Chambers salary in years 2-3 and general infrastructure updates and maintenance during the entire length of the grant period. This included state vehicle use for attending meetings, staff salaries associated with budgetary oversight (e.g., purchasing, accounting, tracking of matching funds, hiring and paying of personnel).

The *DAS website* is accessible under <https://das.wsu.edu/index.php>. The *new spray guide* can be found in the main menu (SPRAY GUIDE) or under this link: https://das.wsu.edu/sprayguide/view_guide, where pest, crop, and crop stage need to be specified to return pesticide recommendations. The video tutorial about the new DAS spray guide is linked in the HELP CENTER (https://das.wsu.edu/help_center) under DAS Features. (Note that additional information provided on DAS will be behind a pay wall starting March 2015.)

PROJECT #12

Project Title: Developing a Sustainability Report Card for WA Concord Grape Production

Partner Organization: Washington State University (WSU)

PROJECT SUMMARY

Concord grape processors are being required by distributors to document sustainable agricultural practices for retail distribution. Several Concord grape-producing states have developed and implemented sustainability assessment tools.

To maintain market presence and retail shelf space accessibility for Washington State Concord grape products, the objective of project was to develop a comprehensive sustainability assessment tool (a “Sustainability Report Card”) for Washington State Concord producers to use in working with their growers.

Distribution and retail organizations including Sysco and Walmart are requiring that agricultural producers and processors document certain aspects of their practices as a condition for providing retail market accessibility. In 2011, Walmart ranked as the largest food retailer in the U.S., and accounted for one-fifth of the market share of groceries. Concord grape products (largely juice, some jellies) are among those under scrutiny with respect to the sustainability of their agricultural practices. The Concord grape juice co-operative Welch’s has received requests from other retailers that document sustainable agricultural practices for their products (Bardwell, personal communication). In order to stay competitive in the marketplace, Washington State Concord grape producers need a means of assessing and documenting the sustainability of their practices.

This project was a new, stand alone project when funded. It has been completed and is viewed as a “terminal” project in terms of funding requests.

PROJECT APPROACH

The project involved a team of WSU extension and research scientists who conduct research in Concord grape production developing an outline for a document to assess Washington state Concord growers’ operations for sustainability. Previous documents developed for wine grapes in Washington, in Lodi California, and for Concord and wine grapes in Michigan and New York were reviewed for formatting. An outline of topics was developed and the WSU team developed an initial document (first draft).

Concurrently, a website was developed for outreach information on the project [<http://wine.wsu.edu/research-extension/sustainability-report-card/>]. This was maintained and updated as new versions of the document were developed.

The first draft was reviewed with a select team of processors (two from National Grape [Welch’s grower arm], one from Milne Fruit Products, and a grower). The feedback from this group was used to revise the document and the second draft was reviewed by the same group with the addition of a representative from Smucker’s.

A comprehensive (third draft) of the document was shared with the representatives from National Grape who then deployed the document as an assessment tool with all 219 of their growers. This constituted approximately 50% of the Concord acreage in Washington and provided additional feedback.

The iterative process continued with revisions from the grower comments, coordinated and discussed with processor and increased grower representation, for two complete additional sets of revisions. The final draft was then submitted to WSU Extension for review as a WSU publication. Comments from the reviewers as well as from Extension Publishing staff were incorporated into a final version.

The final version of the “Washington State Juice Grape Sustainability Report Card” has been printed by WSU Extension Publishing and assembled into 3 ring binders. Processors have been contacted and their requested numbers of binders are scheduled for delivery prior to 26 November 2014.

Extra copies will be at WSU-Prosser for distribution upon request, and WSU-Extension Publications also has 50 copies available. In addition, the entire document, section by section, may be downloaded as a PDF from the website [\[http://wine.wsu.edu/research-extension/sustainability-report-card/\]](http://wine.wsu.edu/research-extension/sustainability-report-card/).

WSU faculty and staff developed the text and formatted the document. This group was responsible for production of a quality product.

Processor representatives from National Grape, Milne Fruit Products, and Smucker's provided input on their needs for working with product distribution as well as from a grower utility perspective. The processors also identified key growers to work with the group on revisions.

This was a specialty crop (Concord grape) specific project.

GOALS AND OUTCOMES ACHIEVED

The underlying objective of this project is to enhance sustainable Concord juice grape production in Washington State and to maintain or enhance Washington’s share of the Concord grape marketplace. The initial work with approximately 50% of the Concord grape acreage in the state indicated that there is already a fairly high level of sustainability. The average overall sustainability index is on a 4 point scale, with 1 being highly sustainable and with 4 being unsustainable. Initial audits (self and with processor assistance) showed an overall high sustainability with a range of 3.0 - 1.2 and an average of 2.3. It is expected that with the deployment of the new assessment tool throughout the industry, there will be efforts to enhance operational sustainability throughout the state.

Initially the intent of this project was to conduct an assessment of the tool with 10% of the growers in year 1 and an additional 10% in year 2. Due to a request by Welchs’ to have all National Grape Cooperative growers undergo a sustainability assessment by August 2012, approximately 50% of the growers/acreage utilized the tool within the first year. The feedback from the assessment lead to a change in plans and more revisions, with increased participation of selected growers in the process. This allowed a much more focused process.

The advantage of this was that it made the development of the final document, submitted for publication through WSU-Extension, occur a little more rapidly than initially expected. The WSU-Extension publishing process was longer than anticipated, so the net result was a slight delay in publication.

By design, this is an ongoing process. Discussions with processor representative on this topic are continuous as are the extension education towards providing new tools for grower sustainability. Much of this will be provided at the upcoming Washington State Grape Society Annual Meeting (13 & 14 November 2014) which is held yearly. While there are other opportunities, this is the most comprehensive session for growers.

***Pesticide Credit Offering**
Three or four pesticide credits will be offered on Friday. You must attend all classes and be a registered attendee to receive credits. Sign-up sheets will be available, requiring your signature at the end of each class.

Does WSGS have your email address?
Please report any email address changes to the registration desk. Here are ways the Grape Society communicates with its members and industry.

- Time sensitive emails, notifying you when there is an immediate need for information.
- Access to the membership website: www.grapesociety.org
- A subscription to the Good Fruit Grower magazine.

Scholarship Fundraiser
Since 1981, WSGS has granted scholarships to deserving students engaged in the field of study related to growing grapes. To date, 77 students have benefited and over \$16,000 in scholarship monies awarded. You can help build this fund for future scholarships by purchasing a raffle ticket for a 1L Tex Elite SmokerBBQ (\$799 retail value) from any board member. All proceeds benefit the scholarship fund. Drawing will be held on Nov. 14th at the end of the Annual Meeting.

Sponsored by:

1-800-872-0972
www.bluebelly.com

DIRECTIONS TO:
The Church of the Nazarene
500 N. Elm Street
Grandview, WA 98930

Exit 75, off I-82. Turn south off the exit ramp to the stop sign at Wine Country Road (Hwy 12). Take a right onto Wine Country Road. The first right hand turn is Elm Street, turn right. Drive north 1/2 mile, the church will be on your left. Entrance will be at the southwest doors, where the Outdoor Trade Show is located.

WASHINGTON STATE GRAPE SOCIETY

2014 ANNUAL MEETING & TRADE SHOW

Register at www.grapesociety.org

Thursday & Friday
NOV. 13 & 14, 2014
8 a.m.—5 p.m.

Location:
500 N. Elm Street
Grandview, WA

Lunch Opportunity
Sponsored by Vine Tech Equipment, SimpliGrow Solutions & WA State Grape Society

Nov. 13th: Pizza Party—(free to registered attendees)

Nov. 14th: Catered Luncheon—\$15 (Please be sure to mark the appropriate boxes) on your registration form. **There will be no lunch tickets sold at the door. This is the only opportunity to purchase lunch tickets.**

Registration Info
Fee for Annual Meeting is \$20 for WSGS Members; \$75 for Non-Member. Membership dues are \$35/Year and payable with conference fee. If you are a Smucker, Milne Fruit, or FruitSmart Grower, dues are paid by the processor. A special Corporate Employee Group Rate is available for up to 5 employees. There is a \$10 registration fee for College students currently enrolled in grape course work.

Pre-registration Deadline is Nov. 1st. No Exceptions. There is a \$25 late fee if received after Nov. 1, payable at the door.

TRADE SHOW EXHIBITORS
Wilson Orchard & Vineyard Supply
Vine Tech Equipment
Conover Insurance Service—Prosser
Inland Desert Nursery, Inc.
Sunnyside New Holland
WA State Farm Bureau
OVS
Ag Pro Systems Inc.
Bluevine Equipment
Bak-J's
Cascade Wind Machines
Orchard-Rite
Walker Close Wine & Culinary Center
Osho
Valley Pipe
YVCC—Vineyard & Winery Technology
Mid Valley Chrysler—Dodge—Jeep
Irrigation Specialists, Inc.
Tom Denchel Ford Country
Linde Vineyard Supply
DW Motor Machines
Saw Nelson Design
Orchard Guard

Thursday, November 13th:
8:00 Registration & Trade Show
8:15 Welcome & Announcements
8:30 Soil Moisture, Temperature & Concord Chatterbox—Joan Davenport, WSU
9:05 Early Watering of Wine Grapes—Panel Chair Bill Riley, Ste. Michelle
9:50 Intro to AgWeatherNet & Hands-on training during break time
10:00 Coffee Break in Trade Show Area
10:30 The State of Drones for Agriculture—Manoj Karkee & Lav Khot, WSU
11:15 Vintage in Review: The Big Concord Crop—Working Management Options—Panel Chair Keith Oliver, Cleen Bros.
1:30 Announcement & Door Prize Drawings
1:40 Business Meeting
1:50 State of the Grapes—Trent Ball, YVCC
2:10 Compost: What is it, what it does & how to use?—Lynne Carpenter-Boogs, WSU
2:45 Coffee Break in Trade Show Area—AgWeatherNet Training & Poster Session
3:25 Nutrient Release from Compost—Dan Sullivan, Oregon State University
4:00 Why Compost Testing is Important: Using Test Results for Soil Benefits—Kyle Barr, Soil Test Farm Consultants
4:30 Door Prize Drawing & Adjourn

Friday, November 14th:
* Denotes Pesticide Credits
8:30 Registration & Trade Show
8:45 Welcome & Announcements
9:00 *Writer Injury/Damage: Causes & Symptoms & WA State Strategic Pest Mgmt Plan—Michelle Moyer, WSU
9:45 *Pollination Survey Results & Sampling Techniques for Leafhoppers—Doug Walsh, WSU
10:20 Intro to AgWeatherNet & Hands-on training during break time
10:25 Coffee Break in Trade Show Area—AgWeatherNet Training & Poster Session
11:00 *Vectors & Movement of REB in CA Vineyards—Brian Buhdar
11:30 *Wound Resistance to Glyphosate—Ian Burke, WSU
12:30 Lunch in Trade Show Area
1:40 AWARDS PRESENTATION
2:15 *Vineyard Safety: Removing Pestic Application Hazards—Sté. Michelle Environmental Health & Safety Services
3:00 *WSDA Survey on Phylloxera Grape Berry Moth—Mike Klutas, WSDA
3:30 *Prepping for Spring: What we can do now to perfect our spraying for next year—Gwen Hohobell, WSU
4:00 Scholarship Raffle (need not be present to win)
4:10 Exhibitor Grand Prize (must be present to win)
4:15 Adjourn

www.grapesociety.org for details & registration form.

BENEFICIARIES

Concord grape processors and growers in Washington State have benefited from this project. At this point in time we don't have the quantitative data that describes the economic impact of the project.

Processors that benefitted from the project – Milne Fruit, National Grape/Welcomes, Smuckers, Tree Top, Valley Processing. (5)

Growers – Approximately 500

LESSONS LEARNED

Assume that a minimum of 4 months is needed for review and publishing with WSU-Extension. Washington's juice grape processors are very good to work with.

There were no unexpected outcomes or results for this project.

CONTACT PERSON

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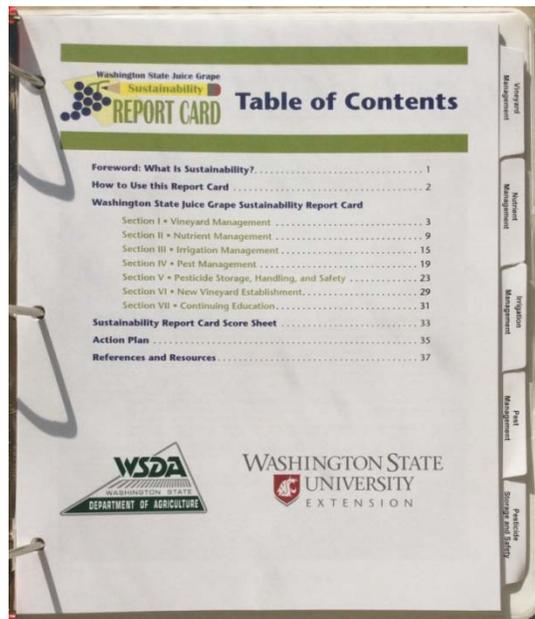
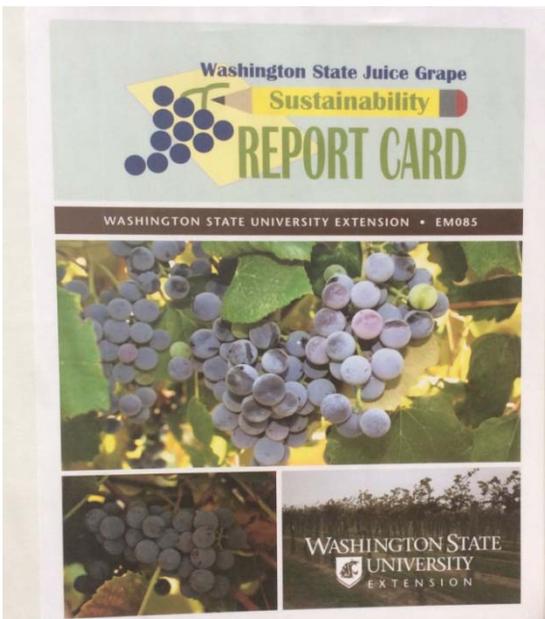
jdavensp@wsu.edu

ADDITIONAL INFORMATION

The in-kind contributions to this project were strictly time allocated by WSU faculty and juice grape processors and growers. Having said this, it is difficult to estimate the total \$ amount, but over the three year period of this grant, salary and benefits would amount to over the dollar value of the grant of circa \$63,000.

Publication available for download at <http://wine.wsu.edu/research-extension/sustainability-report-card/>

Here are images of the cover and front page.



PROJECT #13

Project Title: Improved Management of Hop Powdery Mildew

Partner Organization: Washington State University (WSU)

PROJECT SUMMARY

Podosphaera macularis, the causal agent of hop powdery mildew, was introduced into the Pacific Northwest U.S. in 1997, after years of exclusion by quarantine measures (Gent et al., 2008; Mahaffee et al., 2003). Epidemics of the disease now occur annually and can cause complete loss of marketable yield in susceptible and, as recently reported (Wolfenbarger et al., 2014), in some resistant cultivars due to both direct losses in yield and quality defects when control measures are not applied appropriately. The disease continues to threaten the economic viability of this specialty crop industry valued at \$100 to \$300 million annually (National Agricultural Statistics Service webpage). Costs related to powdery mildew are about 15% of total crop revenue (Mahaffee et al., 2003), which conservatively is over \$10,000,000 annually from increased production costs and crop loss, in addition to impacts on supply stability, brewing quality, and export restrictions due to MRL incongruence in some markets. Current disease management relies heavily on intensive fungicide regimes that are supplemented with certain cultural practices when possible (Mahaffee et al., 2003; Turechek et al., 2001). Targeted disease management strategies are urgently needed to decrease costs associated with powdery mildew control to subsequently increase revenue.

Like all biotrophic fungi, *P. macularis* is exclusively dependent on its host plant. The host-pathogen relationship has been described for other powdery mildew species and follows some principal rules. However, these common observations cannot be over generalized among different powdery mildew species since every host-pathogen relationship follows its own dynamics. A clear understanding on how *P. macularis* exploits the developing hop plant to completely fulfill its life cycle is a key element for successful disease management. Disrupting the balance between fungus and host through adaptation of common cultural practices, such as spring pruning, or well-timed fungicide sprays will help to reduce disease development during the growing season.

The overall objective of this research was to develop and extend practical integrated pest management strategies for hop diseases that will reduce pest management costs and crop damage to maintain the economic viability of the U.S. hop industry. The specific objectives investigated associations of cultural practices and fungicide applications on powdery mildew disease development and their direct influence on yield, and cone quality factors. The gained knowledge directly benefits the growers by broadcasting how small changes in common cultivation practices (e.g. timing and method of cultural and fungicide applications) can decrease powdery mildew disease incidence and severity.

Every year hop growers spend a significant proportion of money on powdery mildew management. Naturally, there is a considerable public interest to reduce these costs while maintaining the high quality of the end product. The prerequisites for disease development are the presence of a susceptible host species (hop plant), a pathogen (*P. macularis*) and the appropriate environmental conditions. This paradigm is also known as the disease triangle. Identifying and understanding interactions among these three factors is indispensable to mitigate disease.

Currently disease prevention relies heavily on prophylactic fungicide applications. In contrast, integrated pest management approaches make use of common cultural practices to disrupt pathogen life cycles and therefore minimize disease incidence. For example, thorough pruning is one of the critical aspects of early season mildew management. Early season powdery mildew occurrences are almost invariably in yards that were not pruned, chemically pruned very early, or left a lot of foliage after pruning. Additionally, previous research has indicated cones are most susceptible to powdery mildew during bloom and the transition period from bloom to cone development, and their susceptibility decreases with continued cone development. Potentially, fungicide applications could be relaxed after the critical period of cone susceptibility if disease pressure was maintained sufficiently low. It is unclear how effective this strategy would be under high vs. low disease pressure and how early termination of fungicide applications would affect overwintering of the

fungus to the following year. The here presented study aimed to elucidate associations between the above described factors and powdery mildew disease development. For this reason, experiments were designed using modifications of and various combinations between common cultural methods (spring pruning, mid-season basal foliage removal). In some experiments, cultural methods were combined with fungicide trials. The overall goal was to reduce powdery mildew inoculum using common-sense techniques and targeted spray regimes.

Since timing of experiments is crucial for project success, every aspect of the project was planned ahead and timeframes were followed tightly. Project collaborators were in constant communication to manage upcoming evaluations or to resolve any arising issues.

This study does not relate to any previously funded SCBGP projects.

PROJECT APPROACH

The goals of the project (2012-2014) were:

1. Quantify the effect of basal foliage management and fungicide spray duration on development of powdery mildew and perennation success of the pathogen. Experiments were conducted in experimental plots at WSU-Prosser and a commercial hop yard to quantify how basal foliage removal and last spray date influence powdery mildew control, cone yield and quality factors, and survival of the fungus in the following year. In each experiment, two fungicide treatments were overlaid on three levels of basal foliage removal intensity to create different levels of disease pressure. In brief, at WSU-Prosser treatments were evaluated in plots of cultivar Galena grown under a short trellis. Three levels of mid-season basal foliage removal were applied (none, removed once, or removed twice), and overlaid on these treatments were three fungicide treatments (no fungicides, sprays up to July 30, and sprays up to August 20). Plots were arranged as a randomized complete block design with four replications, with each plot consisting of nine hills in a single row.

The incidence of leaves with powdery mildew was assessed by inspecting 8 leaves on each of 7 plants per plot (56 leaves per plot) every 14 days throughout the season. At harvest, the incidence of cones with powdery mildew was determined by assessing cones on one lateral branch per plant for signs of powdery mildew. On 3 September, yield was measured by harvesting up to 7 hills from each plot and picking the cones using a Wolf picking machine. Dry matter was estimated from a subsample of cones collected from each plot and used to calculate dry weight yield on a per plant basis. Alpha acid content was determined by the ASBC spectrophotometric method after cones were dried overnight in a small electric dryer. A subsample of cones also was rated for color using a 1 to 10 ordinal scale typical of that used by hop brokerage companies.

Six treatments were evaluated in a commercial hop yard (cultivar Zeus) near Toppenish. Plots were arranged as a randomized complete block design with five replications, with each plot consisting of three rows each containing 13 plants (sub-samples). Plots were separated by at least one row that was left non-treated after July 27. Basal foliage was removed with one, two, or three applications of a herbicide desiccant (2 oz/A Aim EC plus 0.5% v/v Moract crop oil) with the last application being made on 23 July, 1 August, and 15 August, respectively. The first application was applied to the entire field using standard farm equipment. The second and third applications were made with a backpack sprayer in an application volume equivalent to 20 gal/A. On each of the three levels of basal foliage removal, fungicides were applied up to 27 July or August 28. The entire hop yard received the grower's standard fungicide treatments up to 27 July. In all treatments, Quintec was applied at 8.2 oz per acre on 15 July and 27 July. Plots that were sprayed after 27 July received Pristine fungicide at 28 oz/A on 16 and 28 August.

Powdery mildew incidence on leaves was assessed by inspecting 10 leaves on each of 10 plants per plot (100 leaves per plot) every 14 days throughout the season. In September, the incidence of cones with powdery mildew was determined by collecting cones from lateral branches at heights of approximately 9, 12, and 15 feet from the ground on 10 plants from each plot. The cones were bulked before selecting 15 cones arbitrarily from each plant for a total of 150 cones per plot. Each cone was evaluated for signs of powdery mildew. Yield, dry matter, alpha acid content, and cone color were rated as describe previously. Data from both experiments were analyzed using a mixed effects model to determine basal foliage and fungicide treatment effects and relate powdery mildew levels on cones to yield and quality measurements.

2. Disease management influences on bud perennation. In 2012 a new hop yard was constructed at WSU-Prosser and planted with a dwarf USDA hop selection that has a propensity for producing hop powdery mildew flag shoots. This new yard is designed to allow evaluation of different strategies for management of hop powdery mildew flag shoots including timing of pruning strategies and fungicide application. Trials started in May 2013. Due to the very late availability of some planting material in 2012 followed by uneven emergence and growth in 2013, trials involving crown pruning were not conducted in 2013 since the young hops plants would not have recovered from these treatments. Instead only timing of fungicide application on the development of bud infections/flagshoots was investigated in 2013.

A pilot experiment was designed to investigate the time of year crown bud infections might be occurring. Therefore, three different fungicide programs were utilized to identify infection period(s). Treatments consisted of blocked applications of Pristine, Rally, and Quintec applied 1) full season (31 May to 2 Oct); 2) late season (July 8 to 2 Oct) or 3) were not applied (non-treated control). Treatments were applied using a handgun to ensure full coverage. Each plot consisted of 28 plants in two adjacent rows with 2 ft plant and 10 ft row spacing under a 10 ft trellis with one string per plant. Plots were separated by a single row of cv. 'Nugget'. Treatments were arranged in a randomized complete block design with five replications. Presence or absence of disease was assessed for each plant every month from April to October.



3. Disease development with early and late season cultural practices. Experiments were conducted from 2012 to 2014 in a commercial hop yard planted to cultivar Tomahawk near Toppenish, WA. Plots were arranged as a randomized complete block design with four replications. A replicate plot consisted of three rows each containing approximately 13 plants. Plots were separated by at least one row that was treated according to the cooperating grower's production practices for pruning and management of powdery mildew. Treatments were not re-randomized between growing seasons in order to detect possible multi-year effects of treatments on powdery mildew and yield. Two pruning methods were applied on three different dates (termed early, mid, and late) for a total of six treatments. In 2012 and 2013, pruning was conducted on 2 April, 16 April, and 30 April, and in 2014 pruning was conducted on 1 April, 15 April, and 29 April. On each of these dates plots were either mechanically pruned using a rotary pruning implement or the foliage was chemically desiccated (see description above). Applications were made using a backpack sprayer calibrated to deliver an application volume equivalent to 187 L/Ha. Chemical applications were repeated 5 days later to ensure thorough desiccation of the foliage. Inputs of water, fertilizer, and cultural practices were made by the cooperating grower according to standard production practices. The grower also applied other pesticides for arthropod and disease control, including fungicides for powdery mildew. Therefore, the treatment comparisons in this study measured the cumulative effect of pruning timing and method given standard powdery mildew management tactics.

Plants were assessed for the presence of flag shoots and the incidence of plants with powdery mildew beginning just before the first pruning treatments were made and biweekly thereafter until the end of May. After this time, disease assessments were conducted at the leaf level using standard approaches. The incidence of leaves with powdery mildew was assessed by inspecting 10 leaves on each of 10 plants in the middle row of each plot. Assessments were conducted biweekly from early June to late July (2013 and 2014) or early August (2012). In September cones were harvested and processed as described above.

The project was a multi-institutional effort in collaboration with two local hop farmers. The combined knowledge of all contributing partners greatly advanced the outcome and success of the project.

The main collaborators were:

Dr. David Gent is stationed at USDA-ARS facility in Corvallis, OR.

Dr. Gent was the principle investigator of the project. His efforts included (but not limited to) the experimental design of all experiments, establishing and holding farmer collaborations, data collection and evaluation, coordination of all activities conducted by project partners, dissemination of results to growers and through social networking (Facebook).

Dr. Gary G. Grove, Professor and Plant Pathologist, is stationed at WSU in Prosser, WA.

Dr. Grove was the second principle investigator. His efforts included (but not limited to) the oversight of experiments conducted at WSU, being the interface with all levels of management and staff involved for the coordination of activities; being a resource to all project partners on administrative matters, and the dissemination of results through meetings and social networking (Facebook).

Dr. Claudia Probst is a Post-doctoral Research Associate at WSU, Prosser.

Dr. Probst executed all experiments at WSU-Prosser and at the commercial yards in Toppenish which included the bi-weekly disease evaluations, data entry and analyses.

Mark E. Nelson, Research Tech. Supervisor, WSU, Prosser.

Mr. Nelson designed and supervised experiments conducted at WSU-Prosser. Additionally, he managed the hop yard cultivation and season long propagation, and analyzed results collected during the season(s).

John I. Haas, Inc., Yakima, Cooperative farmer.

Mr. Haas provided and maintained a hop yard for experimental studies which enabled the project to replicate experiments conducted at WSU in Prosser on a commercial scale.

Perrault Farms, Inc., Toppenish, Cooperative farmer.

Mr. Perrault provided and maintained a hop yard for experimental studies which enabled the project to conduct a study on the relationship of spring pruning timing and disease development.

The overall objective of this research was to develop and extend practical integrated pest management strategies for hop diseases that will reduce pest management costs and crop damage to maintain the economic viability of the U.S. hop industry. The causal agent of hop powdery mildew, *P. macularis*, is an obligate biotroph of hops. Hence, research directly concerns the hop-mildew relationship and results cannot be applied to other crops.

GOALS AND OUTCOMES ACHIEVED

Completed objective: Quantify the effect of basal foliage management and fungicide spray duration on development of powdery mildew and perennation success of the pathogen.

Continuing objective: Disease management influences on bud perennation.

Measurable outcomes:

- First (and only) flag shoot was found on April 23rd 2014 = primary inoculum
- Slow disease development in May
- Explosive disease development beginning of June with fairly uniform distribution (with infected plants in all blocks and reps). This created the perfect conditions for the flag shoot evaluation in 2015 to assess if fungicide treatments were able to prevent flag shoot formation through elimination of overwintering inoculum.

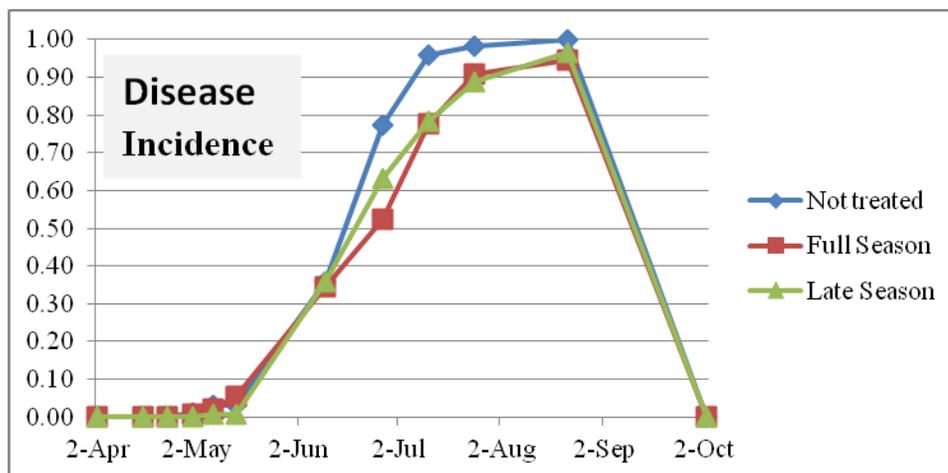


Figure 1 Disease incidence on dwarf USDA selection at WSU experimental hop yard in Prosser, WA.

Completed objective: Disease development with early and late season cultural practices.

Measurable outcomes:

- No flag shoots were observed in the hop yard in 2012 and 2013. One flag shoot was found in 2014.
- Neither pruning timing nor method affected the dry matter content of cones or cone color, which might be a function of both the severity of powdery mildew and relatively late harvest date.
- Cone yield, alpha acid content of cones, and alpha acid yield were similar among treatments.
- Reductions in powdery mildew on leaves have been associated with later pruning. Effects on cone quality were inconsistent between years, which are likely heavily influenced by the timing of harvest. Importantly, delaying spring pruning did not negatively affect yield.
- The benefits of delayed spring pruning appear twofold, both reductions in disease severity (particularly early season) and a savings of one or more fungicide sprays simply due to avoiding several weeks of powdery mildew favorable weather in early spring.

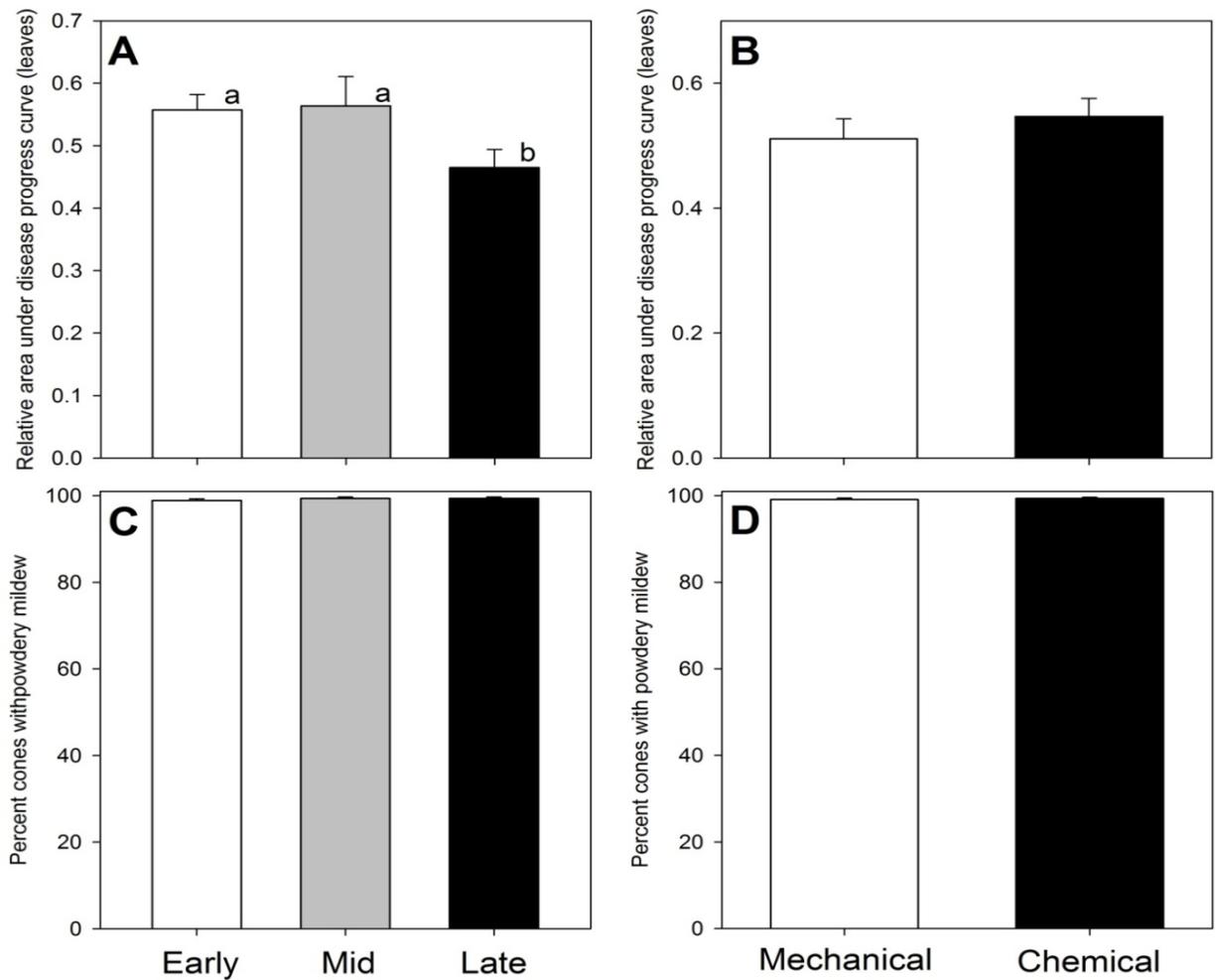


Figure 2. Incidence of powdery mildew on leaves (**A and B**) and cones (**C and D**) in relationship to pruning timing and method. Pruning dates were April 2 (early), April 16 (mid), or April 30 (late). Means with different letters are significantly different ($P = 0.05$). Data is from cultivar Tomahawk, Toppenish, WA 2013.

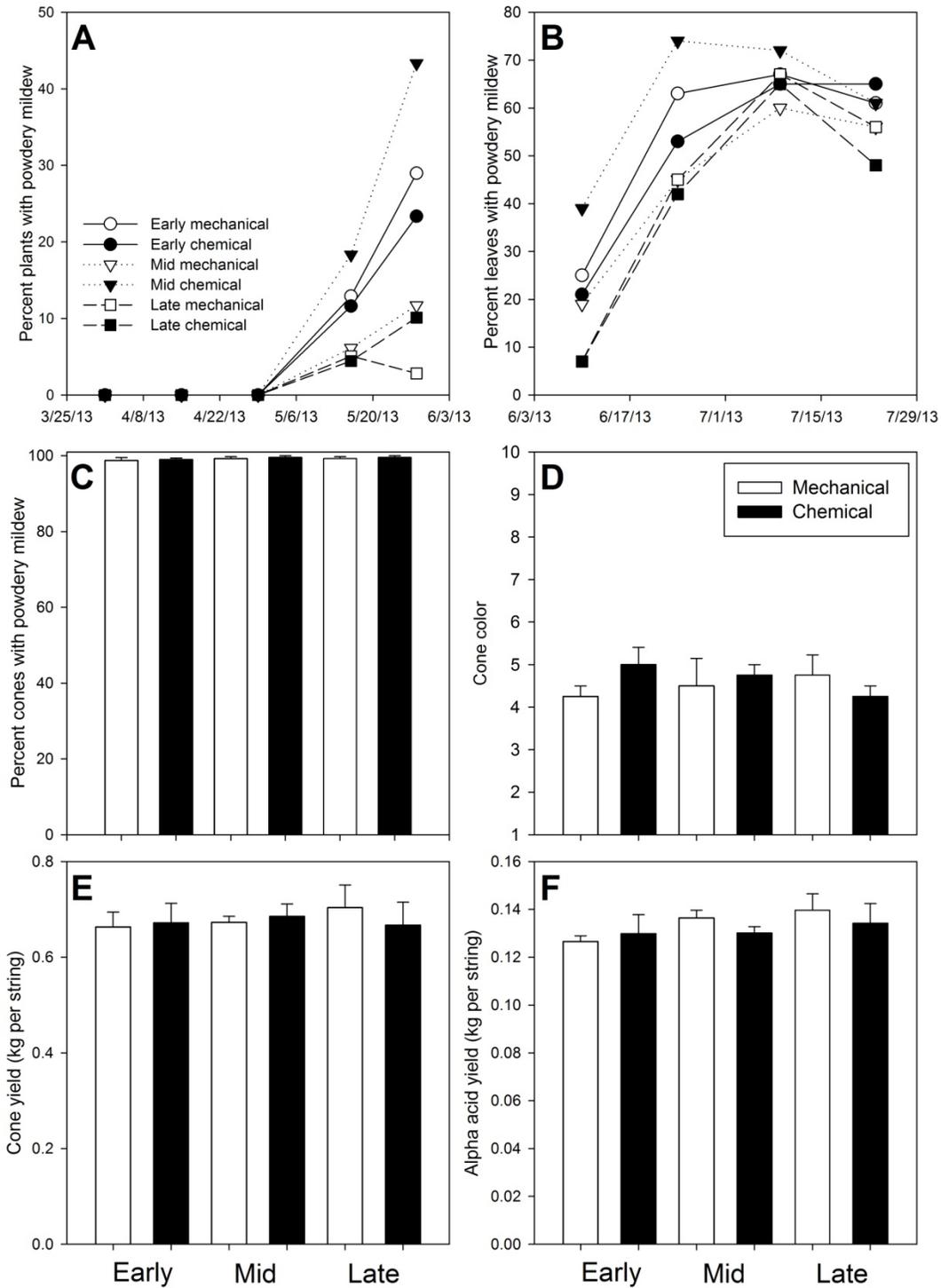


Figure 3 Incidence of powdery mildew on plants (A), leaves (B), and cones (C) when pruned mechanically or chemically on three different dates in 2013. Cone color, cone yield, and alpha acid yield are presented in D, E, and F, respectively. Pruning dates were 2 April (early), 16 April (mid), or 30 April (late) on cultivar Tomahawk, Toppenish, WA 2013. Error bars are not included in A and B to reduce clutter.

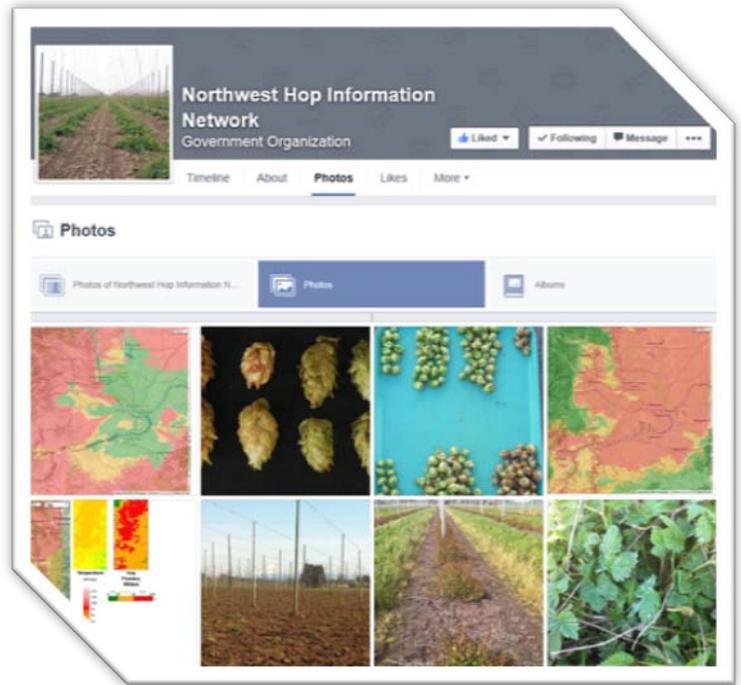
Developing and maintaining a social networking platform is a continuing, long-term goal. The site will remain open and running after completion of the here described project.

The here described study encompassed pilot experiments based on observations made during previous years. There was no baseline data in 2012. Data was gathered during the three year study and results were found to be consistent over the years. Overall, the project has been a great success.

BENEFICIARIES

The project’s primary beneficiaries are U.S. Hop Growers. The results are very practicable since spring pruning, basal foliage removal and fungicide spray regimes are practices used by all growers. Slight modifications of already used practices can result in great disease control minimizing costs while keeping the quality of the cones high. These changes also lead to minimized residue levels from fungicide sprays, a result that not only benefits the Growers but also the Consumers and increases export chances to countries imposing strict MRLs.

The implementation of a social networking site (Facebook: [Northwest Hop Information Network](#)) was a great success. The project site reached hundreds of people relating to or working with hops (Industry, Research, Hobby). The site offers advice and answers questions about most hop diseases and their management, served as a platform to publish results the second they became available. This is particularly helpful since the time needed to prepare and publish results in Journals is increasingly lengthy. The increasing popularity is also reflected by the steadily increasing numbers of ‘Likes’ mainly due to the great effort exerted by the site administrators (Drs. David Gent and Gary Grove). In addition to the online distribution, continuous presentations at Industry kept Growers and Industry parties informed about ongoing research activities, encouraged exchange of ideas and identified ongoing problems regarding powdery mildew disease management.



Last, national and international researchers working on powdery mildew control will benefit from the insights into the fungal biology. Every study brings new results that directly or indirectly shape future projects. Keeping the research going remains a key element for the future of healthy hops.

Reductions in powdery mildew on leaves have been associated with later spring pruning. Effects on cone quality were inconsistent between years, which are likely heavily influenced by the timing of harvest. Importantly, delaying spring pruning did not negatively affect yield.

The benefits of delayed spring pruning appear twofold, both reductions in disease severity (particularly early season) and a savings of one or more fungicide sprays simply due to avoiding several weeks of powdery mildew favorable weather in early spring.

LESSONS LEARNED

Working with obligate biotrophic fungi has always been a challenge since those fungi only thrive in contact with a susceptible host under the right environmental conditions. Conducting field experiments heavily relies on the well-being of the host plants. Proper farm management and continuous inspection of experimental sites is recommended for the success of these experiments. Unexpected problems can always arise but usually, if found early, can be worked out. Therefore, a steady communication with project partners, collaborators, staff members and the farm crew is essential to ensure those problems are identified and solved without jeopardizing the success of the project.

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ADDITIONAL INFORMATION

Two publications, to be published in a peer-reviewed internationally recognized Journal (e.g. Plant Disease) are in preparation. The anticipated publication year is 2015.

Literature Consulted

1. Coley-Smith, D. J. 1964. Rep. Dep. Hop Res. Wye Coll. 1963:30-31.
2. Fernandez-Cornejo, J. and Castaldo, C. 1998. J. Prod. Agric. 11:497-506.
3. Gent, D. H., Nelson, M. E., George, A. E., Grove, G. G., Mahaffee, W. F., Ocamb, C. M., Barbour, J. D., Peetz, A., and Turechek, W. W. 2008. Plant Health Progress doi:10.1094/PHP-2008-0314-01-RV.
4. Hickey, K. D. and K. S. Yoder. 1990. Compendium of Apple and Pear Diseases. APS Press, St. Paul, MN.
5. Lam, T. C. and Bengo, P. 2003. Am. J. Evaluation 24:65-80.
6. Lev, L. S., McGrath, D., Murray, H., and William, R. D. 1993. J. Nat. Resour. Life Sci. Educ. 22:148-152.
7. Liyanage, A. de S., and Royle, D. J. 1976. Ann. Appl. Biol. 83: 381-394.
8. Mahaffee, W. F., Thomas, C. S., Turechek, W. W., Ocamb, C. M., Nelson, M. E., Fox, A., and Gubler, W. D. 2003. Plant Health Progress doi:10.1094/PHP-2003-1113-07-RV.
9. Rodgers, E. 2003. Diffusion of Innovations. Fifth Edition. Free Press, New York.
10. Royle, D. J. 1978. The Powdery Mildews. D. M. Spencer, ed. Academic Press, London.
11. Turechek, W. W., Mahaffee, W. F., and Ocamb, C. M. 2001. Plant Health Progress doi:10.1094/PHP-2001-0313-01-RS.
12. Wolfenbarger, S.N., Eck, E. B., Ocamb C. M., Probst, C., Nelson, M.E. and Grove, G.G., Gent, D.H. Plant Disease, 2014. 98(6): p. 852.

PROJECT #14

Project Title: Sanitization of soft fruits with ultraviolet (UV-C) light

Partner Organization: USDA, ARS, Eastern Regional Research Center (USDA)

PROJECT SUMMARY

The recent Food Safety Modernization Act established minimum standards for the safe production and harvesting of fruits and vegetables, based on known safety risks. Each registered food processing or packing facility/plant will be required to conduct a hazard evaluation to identify “known or reasonably foreseeable hazards,” including biological hazards. Each registered facility is then required to implement preventive controls or provide assurances that the identified hazards will be significantly minimized or prevented. Currently, almost all fresh fruit and vegetable facilities utilize aqueous sanitizers to wash fresh fruits and vegetables. Chlorine is the most widely used sanitizing agent for fresh produce despite chlorine’s limited efficacy (ca. 1-2 log inactivation) in reducing human pathogens on fresh produce.

Some fruit growers/packers have been marketing high-maturity fruit for years to satisfy consumers’ increasing demand for high quality/improved-flavor fresh fruits. The so-called “tree ripe” fruits are usually harvested at greater than normal maturity. Because of the softness associated with advanced maturity, these fruits will not withstand the rigors of typical commercial packing lines. Washing with aqueous sanitizers (or just water) damages fruit surfaces and shortens their shelf-life. Therefore, non-aqueous sanitization techniques are needed for these types of fruit. Ultraviolet light is a nonthermal/nonchemical intervention technology that employs physical light energy of a specific wavelength to inactivate microorganisms. The FDA has approved the use of UV light at a wavelength of 254 nm as a disinfectant to treat food.

Although UV-C may be able to reduce pathogens on the surface of fruits, there are several challenges for the commercial application of UV technology. First, some fruits may develop discoloration after UV-C light treatment, particularly during post-UV storage. Second, pathogens that reside in stem ends and in crevices and small cracks on the surfaces of fruit may be shadowed and not exposed to UV light. Third, injury to bacterial pathogens by exposure to UV light may later be repaired by dark and/or by enzymatic mechanisms, leading to potential cell survival and re-growth. Perhaps the most significant challenge to the commercial application of UV-C technology is ensuring uniform exposure of UV light to all surfaces of the fruit. Finally, lack of consumer acceptance has limited the use of some technologies that offer increased product safety. Understanding consumer acceptance of UV-C treatment is an important component to advance use of the technology.

In this project, we assessed the efficacy of UV-C in inactivating human pathogens (*E. coli* O157:H7 and *Salmonella* spp.) and in maintaining fruit quality and shelf-life of fruits after UV treatment. For the first time, radiochromic film dosimeters were verified and applied to UV-C processing of fruits. Furthermore, to ensure uniform UV-C exposure of all fruit surfaces, two types of rotating devices were developed. In addition, a large scale trial was conducted at our industrial collaborator’s site to study the effectiveness of UV-C in reducing a surrogate of *E. coli* O157:H7. Apricots were tolerant to UV-C at doses up to 442 mJ/cm² without significant changes in fruit quality. *E. coli* and *Salmonella* population on apricot fruit after exposure to high doses of UV-C decreased rapidly during post-UV-C, suggesting that human pathogens did not survive well after UV-C exposure. Results showed that UV-C could reduce population of *E. coli* O157:H7 and *Salmonella* spp. on apricot fruit by 99 % in the lab setting. However, in the commercial trial, the reduction was limited (70-80%) even through a sloped belt was used to rotate the fruit. The low reduction in bacterial population is probably due to uneven UV exposure to surface of fruits as suggested by the radiochromic film dosimeters attached on the fruit surface. Use of reflective material such as stainless steel and aluminum foils did not provide significant improvement in dose uniformity. A rotating device modified in the lab could achieve high UV dose uniformity of fruits. The device needs to be scaled up and applied in a commercial setting. A consumer survey (90 respondents) indicated that 67% of consumers found the use of UV-C to enhance the safety of fresh produce moderately to completely acceptable, which was equivalent to the acceptability for use of UV-C to enhance safety of drinking water. A greater percentage of consumers found UV-C treatment to enhance the safety of produce very or completely acceptable (28%) compared to the use of irradiation to enhance the safety of spices (14%) or leafy green vegetables (17%). Results from the project suggested that UV-C

technology will enable the fruit industry to meet the requirements of the FDA Food Safety Act while improving the microbial safety and increasing the consumption of healthful fresh fruits. The UV technology developed in the proposed study will not only allow many grower/packers to continue marketing the tree-ripe fruits, but also will enable the fruit industry as a whole to adapt the technology to other types of fruits such as apples.

PROJECT APPROACH

Ultraviolet-C (UV-C) treatment chambers were built for use in studies involving pathogen reduction and quality changes. ARS conducted the following experiments: 1). Efficacy of UV-C in inactivating pathogenic and non-pathogenic *E. coli* O157:H7 and *Salmonella* spp. 2). The survival of pathogenic *E. coli* O157:H7 and *Salmonella* spp. during post-UV storage. 3). Development of UV-C film dosimeter systems to evaluate dose uniformity. In addition, UV-C treatment system was installed in a commercial packing line at the industry collaborator - Double Diamond Fruit Co. The UV-C treatment system was tested for UV-C intensity, reduction of surrogate bacteria, UV dose uniformity on apricot fruit, and fruit quality changes during post-UV storage. The film dosimeter system was used to study the dose uniformity on different locations of fruit surface in the commercial and lab settings. To increase dose uniformity, two rotation devices were developed and evaluated. One device is a sloped belt that connected two UV-C treatment chambers. The sloped belt rotated fruit after exiting from the first UV-C chamber. The second rotating device was a modified five roller grill. The heating element of the roller was disconnected, and new motor and chain were installed to increase the rotation speed.

Results showed that 10 sec UV-C treatment could inactivate 99% of *Salmonella* spp. and *E. coli* O157:H7 on apricots. Bacteria on fruit treated with UV-C at higher doses died much more rapidly than those on non-treated fruit during post-UV storage at either 2 °C or 20 °C. UV-C treatments had no significant effect on color, firmness, acidity, soluble solids content, browning, mealiness or decay of fruit. Even though UV-C treatment can achieve 99% reduction of *E. coli* O157:H7 and *Salmonella* spp. populations in laboratory settings, inactivation of *E. coli* at the commercial setting was slightly lower, with only 70-80% reduction of *E. coli* population. The low reduction was likely due to un-even UV dose distribution on different location of fruit surface because one third of the fruit (20 of 60) had part of fruit surface receiving very low dose of UV-C, suggesting that the simple sloped belt may not be sufficient to achieve uniformed UV-C exposure. The rotation on the sloped belt was a random process with no insurance of a piece of fruit being turned to the opposite surface and exposed to UV-C on both sides.

Because the sloped belt did not provide satisfying results, we tested the modified roller in lab setting by comparing with the use of reflective materials without the use of the rotating device. Radiochromic films were attached at six different locations of fruit. Results showed that fruit treated with the rotating device had much better UV-C dose uniformity than those without the rotating device as indicated by the coefficient of variations and the ratio of maximum/minimum doses. Therefore, use of the rotating device can dramatically increase dose uniformity. The device needs to be scaled up and tested at a commercial setting.

Consumer knowledge of some commonly used processing technologies appears to be low, which could make communication about current and new technologies challenging; 55% were not at all aware of chlorine use for safety in fruit and vegetable processing. A consumer survey (90 respondents) indicated that 67% of consumers found the use of UV-C to enhance the safety of fresh produce moderately to completely acceptable, which was equivalent to the acceptability for use of UV-C to enhance safety of drinking water. A greater percentage of consumers found UV-C treatment to enhance the safety of produce very or completely acceptable (28%) compared to the use of irradiation to enhance the safety of spices (14%) or leafy green vegetables (17%). Over one-third (40%) of consumers were very or completely interested in learning about UV-C treatment of produce. The terms and “ultraviolet light” and “ultraviolet” were preferred by a higher percentage of consumers (37% and 27%, respectively) to describe a food safety technology involving UV-C treatment of produce compared to terms using “pulsed light” (5%).

PI, Dr. Xuetong Fan, along with visiting scientists, conducted experiments regarding the impact of UV-C on populations of human pathogens and fruit quality, evaluation of UV-C film dosimeters, and development of rotating device. Co-PI, Dr. Joshua Gurtler, helped to evaluate the reduction of *E. coli* and *Salmonella* by UV-C treatment. Co-PI, Dr. Karen Killinger conducted a consumer survey (90 respondents) on consumer acceptance of UV technology. The Double

Diamond Fruit Co contributed significantly to the project. Double Diamond Fruit Co. provided fruit for experiments, and installed the UV-C system on their commercial packing line, assisted in evaluation of UV-C system for the reduction of bacteria and quality changes. In addition, USDA, ARS, Tree Fruit Research Laboratory analyzed fruit quality of apricot during storage.

GOALS AND OUTCOMES ACHIEVED

Two research scientists (one full time and one part time) and two part-time students were employed to perform the majority of experiments for the project. An Assistance Type Cooperative Agreement (ATCA) was established between USDA-ARS and Washington State University to deliver the sub award (\$11,477) for studying consumer acceptance of UV-C technology. All goals have been achieved.

Objective	Timeline	Goal met
Hiring of technician/research assistant. Acquisition of research supplies, materials and equipment. Project team meets to discuss the project and design experiments.	Jan 2012	Yes
Objective 1: Determine UV-C sensitivity of <i>E. coli</i> O157:H7 and <i>Salmonella spp.</i> inoculated on apricots or peaches	Feb - Apr 2012	Yes
Objective 2: Evaluate the survival and growth of pathogens on apricots/peaches during storage at 4 and 20°C	May - Jul 2012	Yes
Objective 3: Determine quality changes and shelf-life of apricots/peaches following UV treatment and storage at 4 and 20°C	Jul - Sept 2012	Yes
Objective 4: Study the uniformity of UV exposure across the surface of fruits	Jan-Mar 2013	Yes
Objective 5. Conduct commercial trials at Double Diamond Fruit Co., WA.	Jun - Aug 2012	Yes
Objective 6. Evaluate consumer acceptance of UV technology	Mar-Apr 2013	Yes

The results were presented at Center for Produce Safety Produce Research Symposiums, June 25-26, 2013, in Rochester, NY, and at the Institute of Food Technologists Annual Meeting and Food Expo, July 13-16 in Chicago, IL. In addition, results were published by the International Journal of Food Microbiology (Yun, J., R. Yan, X. Fan, J. Gurtler, J. Phillips. 2013. Fate of *E. coli* O157:H7, *Salmonella spp.* and potential surrogate bacteria on apricot fruit, following exposure to UV-C light. International Journal of Food Microbiology. 166(3):356-63.) Furthermore, a manuscript has been submitted to the journal of Postharvest Biology and Technology, and two more manuscripts are being prepared.

BENEFICIARIES

The results from the research suggested that apricot fruit can tolerate high doses of UV-C without change in fruit quality. UV-C treatment reduced the population of human pathogens by as high as 99% in laboratory setting. In the commercial setting, the reduction was 70-80%. A film dosimetry system was developed to evaluate dose distribution on individual fruit. Therefore, the results showed that UV-C can be used to enhance microbial safety of fruits without impacting quality. The consumer survey advanced the understanding of consumer acceptance of UV-C technology for enhancing safety during produce processing and identified preferred consumer terminology “ultraviolet light” for UV-C treatment. The technology has been implemented by our collaborator, Double Diamond Fruit Co., and used to produce safer fruit. The technology can be applied to other companies to apricots or other fruits and vegetables to enhance microbial safety.

The U.S. Food and Drug Administration (FDA) Food Safety Modernization Act requires growers/packers of fresh fruits and vegetables to adopt preventive microbiological controls to minimize the risk of human pathogens. The adoption of the UV-C technology would enable growers and packers to comply with the recently-enacted FDA requirements, improve the safety of fresh fruits, and increase the consumption and sales of high-quality/improved flavor fresh fruits. At least one major packer in Washington State has implemented the technology on apricots. And a few other companies are considering to apply the technology on mushrooms, strawberries, and other fruits. It is hard to estimate the economical impact of the project or give an exact dollar number. In essence, the technology developed in the research allows packers

and growers to continue marketing delicate fruits and other foods which can not withstand the rigors of typical commercial packing lines or aqueous sanitizers.

LESSONS LEARNED

Hiring student/visiting scientists required much longer time than we expected, resulting in a 3-month delay.

Due to the difficulties in scheduling focus groups, the study on consumer acceptance was restructured to a phone survey at Washington State University.

We have conducted more experiments than those outlined in the proposal. We tested the efficacy of UV-C on peaches and apples in addition to apricots.

Ideally, fruits should be rapidly and randomly rotated in multiple planes, allowing all-surface exposure from multiple directions and angles of the UV light. Generating random movement of fruits using a roller will help provide uniform UV exposure of all fruit surfaces, which is necessary for a large-scale application. We have developed a better rotating device to further reduce population of human pathogens on fruit. Due to time and resource restrains, we are unable to test it in the commercial setting.

CONTACT INFORMATION

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PROJECT #15

Project Title: Filling the gaps in nematode management in potatoes

Partner Organization: Washington State Potato Commission (WSPC)

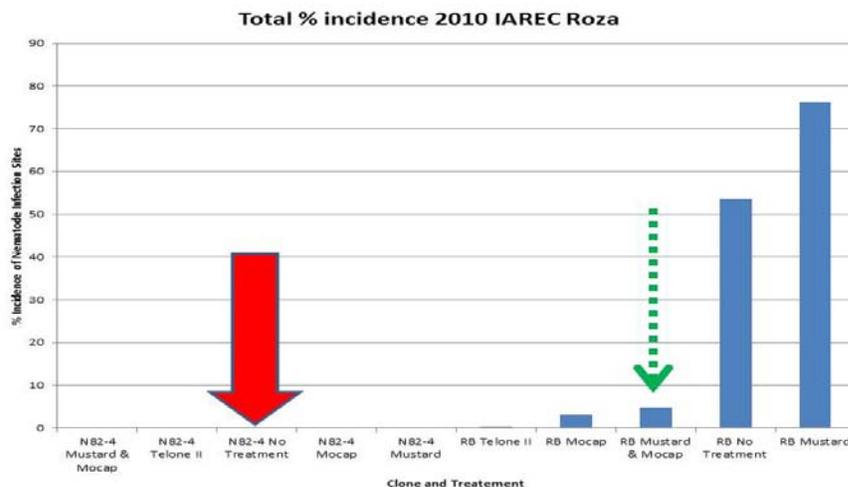
PROJECT SUMMARY

The plant-parasitic Columbia root-knot nematode (*Meloidogyne chitwoodi*) is an annual, nearly ubiquitous pest of potato production in the Pacific Northwest. The overall goal of this project was to develop tools and information to improve plant-parasitic nematode management in potatoes, allowing a more integrated management approach than was possible. The specific objectives of this project were to:

1. Test the performance of a *M. chitwoodi*-resistant breeding line that is close to release compared with the historical industry standard cultivar, Russet Burbank, under full commercial fumigation and under varying degrees of soft nematicide and green manure options.
2. Study the plant infection process and how to interrupt it by deactivating *M. chitwoodi* effector genes and analyzing their functions during plant infection.
3. Increase grower and crop consultant understanding of nematode biology, symptoms, and management options.

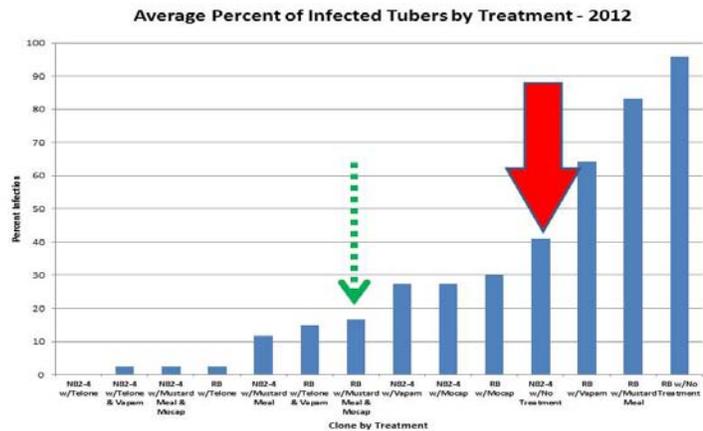
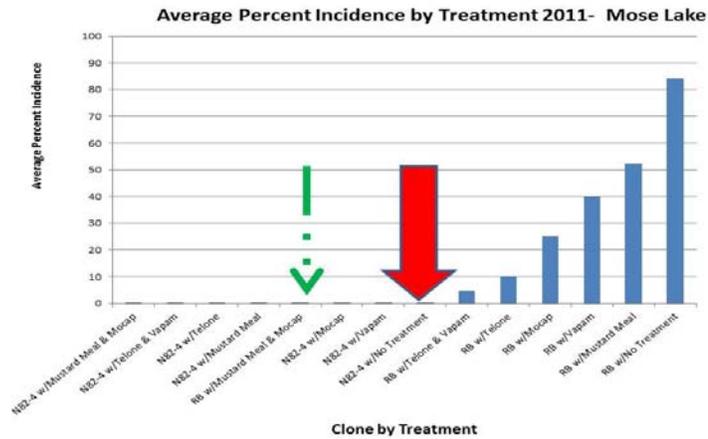
This project was important and timely because current nematode management is reliant on nematicides and soil fumigants that are expensive (up to 10% of cost of production) and are gradually being phased out and/or facing use restrictions. The sustainability and profitability of the potato industry stand to benefit greatly from a broader base for nematode management. Our work addressed WSDA funding priority 1 (Controlling Pests and Diseases) by developing new tools and information to control *M. chitwoodi* in potatoes. Additionally, this research addressed priority 4 (Enhancing International Trade/Reducing Market Barriers). *M. chitwoodi* is a quarantine pest that interferes with the international trade of seed potatoes and tubers for the fresh market. Growers suffered significant economic losses when infested shipments were denied entry into importing countries. By providing new management options, this project helped growers to overcome these trade barriers.

PROJECT APPROACH



1. Test the performance of a *M. chitwoodi*-resistant breeding line that is close to release compared with the historical industry standard cultivar, Russet Burbank, under full commercial fumigation and under varying degrees of soft nematicide and green manure options.

Data graphs depict three years of field trials which were conducted on Russet Burbank and N82-4, with Telone, mustard meal, Mocap, and an untreated check. In 2011, Vapam and Vapam/Telone treatments were added.



Conclusions and Findings: N82-4 exhibited such a significant degree of nematode resistance in field plots that there was almost no incidence of tuber damage. In contrast, Russet Burbank was very damaged by nematodes in untreated plots. Vapam and Telone are effective fumigants, so the industry standard continues to prove effective in field trials. Mustard meals was not as efficacious as hoped, as was demonstrated in our 2010 and 2011 field data results. The estimated number of nematodes in field plots was acquired before applying fumigant treatments and after the harvest. An interesting further result of investigation is that N82-4 untreated plots had very low nematode counts at the end of the season, whereas Russet Burbank *M. chitwoodi* counts were high. Anecdotally, the N82-4 appears to scrub the plots clean of nematodes. Historically Vapam was used to control early dying caused by *Verticillium*. Researchers discovered that Vapam was also a good fumigant for *M. chitwoodi* when injected into the soil, and has remained a key tool. As noted in data graphs, mustard meal controls up to 90% of the *M. chitwoodi*, but this is not sufficient to offer an appropriate level of control for commercial production. However, mustard seed and Mocap may hold promise for an application combination. This treatment combination warrants further study.

In year three, N82-4 had some damage in the field of unknown origin. The region was unusually hot, and the soil temps were elevated well above average. It is possible that treatment pressures either selected for more resistant or robust

nematodes, or the gene may be impacted by temperature. More investigation is needed to determine if there was a temperature effect on gene expression. Preliminary studies done on-site were not fully conclusive.

2. Study the plant infection process and how to interrupt it by deactivating *M. chitwoodi* effector genes and analyzing their functions during plant infection.

The ability of root-knot nematodes to infect plants and to establish themselves as parasites is based on secretions from the nematodes' salivary glands, which are called effectors. In this project we focused on *16D10*, an effector gene that was previously found in other root-knot nematodes but had not been identified in *M. chitwoodi*. A combination of genome analyses and molecular biology approaches enabled the isolation and subsequent sequencing of the *M. chitwoodi 16D10* effector gene. This set the stage for a targeted disruption of the interactions between *M. chitwoodi* and its host plants. This study was a milestone for root-knot nematode control because previous investigations were strictly based on the model plant *Arabidopsis* or transgenic hairy roots. In contrast, this project was the first in developing transgenic potato lines aimed at developing root-knot nematode resistance by disrupting effector function.

In a first set of experiments, the expression pattern of *16D10* was confirmed throughout the development of the nematode. It was found that the *16D10* gene is most highly expressed in the second-stage juvenile, which is the infective stage. This indicated a potentially important role of *16D10* for *M. chitwoodi* parasitism. To deactivate the *16D10* effector gene in *M. chitwoodi*, an RNA interference (RNAi) construct was introduced into *Arabidopsis* and potato cv. Desiree. This system essentially poisons the nematode. The plant is producing double-stranded RNA (dsRNA) that is complementary to the target gene in the nematode, in this case *16D10*. Upon infecting plants, the nematodes are taking up plant cell contents, including dsRNA. This leads to a deactivation of the *16D10* gene in the nematode through a complex process that destroys *16D10* sequences in the nematode. *Arabidopsis* served as an easily manipulated model system and potato cv. Desiree was chosen because it lends itself to rapid genetic transformation and provides a reference point for potato. Transgenic plants were inoculated with *M. chitwoodi* and nematode reproduction was assessed at 35 and 55 days after inoculation (DAI). Compared to empty vector control plants, the number of *M. chitwoodi* egg masses and eggs in *Arabidopsis* with the RNAi transgene was reduced by up to 57 and 67%, respectively. In transgenic potato lines, a reduction in the number of *M. chitwoodi* eggs and egg masses of up to 71 and 63%, respectively, was observed. An analysis of *16D10* gene activity in *M. chitwoodi* indicated a 76% reduction of the transcript in nematodes developing on transgenic *16D10* RNAi plants.

In a subsequent set of experiments, the initial investigations were expanded. After finding that introducing a *16D10* RNAi transgene into potato cv. Desiree is feasible and provides *M. chitwoodi* resistance, the same transgene was introduced into the economically important cv. Russet Burbank, Ranger Russet, Umatilla and PA99N82-4, an advanced breeding line that carries a natural resistance gene against some isolates of *M. chitwoodi*. Transgenic lines were established for Russet Burbank and PA99N82-4, but Ranger Russet and Umatilla proved recalcitrant to tissue culture manipulations and had to be eliminated from the study. Resistance against *M. chitwoodi* was evaluated at 35 and 55 DAI. In cv. Desiree and cv. Russet Burbank carrying the *16D10* RNAi transgene, the number of *M. chitwoodi* egg masses and eggs was reduced by up to 68 and 65%, respectively. In addition, transgenic RNAi lines of PA99N82-4 reduced *M. chitwoodi* pathotype Roza egg and egg mass production by 47 and 44%, respectively. This is an important finding because pathotype Roza is found in Washington and overcomes the only known *M. chitwoodi* resistance gene in potato. An extremely important finding of this study was that the resistance effect is transmitted to nematode offspring. It was found that if wild type plants are inoculated with offspring of nematodes that developed on *16D10* RNAi plants, the wild type plants are protected at the same level as their transgenic counterparts. This could have important practical implications - for example, nematode protection could be provided by transgenic plants but not all plants in a field would have to be transgenic to obtain resistance for all plants in the field.

M. chitwoodi is the most important root-knot nematode pest in potato in the Pacific Northwest, but certainly not the only one. To test whether the transgenic potato lines developed in this study hold up under pressure from other root-knot nematodes, cv. Russet Burbank carrying the *16D10* RNAi transgene was inoculated with *M. arenaria*, *M. hapla*, *M. incognita*, and *M. javanica*. At 35 DAI, the number of egg masses was reduced by 65 to 97%. At 55 DAI, the number of

eggs was reduced by up to 87%. However, deactivation of *16D10* did not interfere with root-knot nematode attraction to or invasion of host roots.

3. Increase grower and crop consultant understanding of nematode biology, symptoms, and management options.

To improve grower knowledge about nematodes, three laminated outreach and education cards were developed, one each for *M. chitwoodi*, *Pratylenchus* spp., and *Paratrichodorus allius*, the three most important types of nematodes in potato in the Pacific Northwest. Each card included high quality pictures of typical symptoms, nematode life stages, information about the nematode life cycle, and control measures. Cards were distributed through the Washington State Potato Commission.

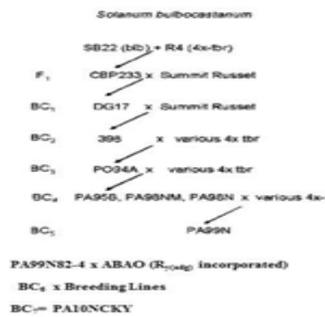


Furthermore, regional presentation and discussions on nematode biology were enhanced with visual aids, graphs, and summaries developed as part of this project. For example, the strength of nematode resistance shown by N82-4 as contrasted against Russet Burbank is clearly illustrated in the below image.

The project was jointly overseen by Drs. Jensen, Elling, and Brown. Dr. Jensen was the overall project leader and managed the grant. Dr. Brown was responsible for objective 1, Dr. Elling led objective 2, and Dr. Jensen led objective 3. A regular exchange of ideas and progress reports among the three scientists ensured a timely completion of all objectives. This project only benefitted the specialty crop industry, specifically potatoes.

GOALS AND OUTCOMES ACHIEVED

Below is depicted a pedigree of the derivation of advanced resistant oblong russet skin potatoes. The initial hybridization step was protoplast fusion because the source wild species is very reproductively isolated from cultivated potato. Fortunately the initial somatic hybrid and successive descendants were female fertile and allowed for eight generations of backcrossing which ensconded the resistance factors in amongst the genetic matrix of a modern potato of use to the



processing industry.

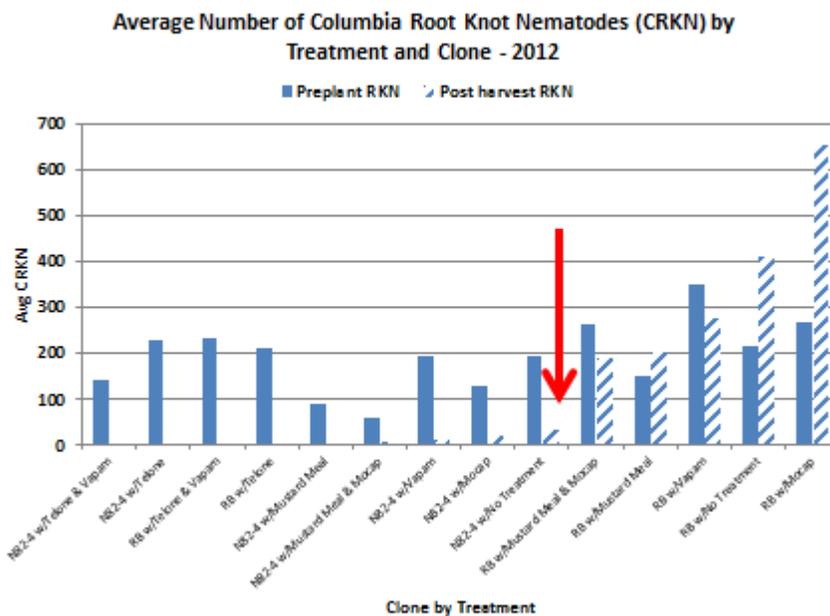
Additional discoveries of interest further support our hypothesis that the gene controlling root resistance is separate from the gene controlling tuber resistance. This is an important distinction, and will aid in future breeding efforts. *M. chitwoodi* costs the growers a great deal of money, and finding alternatives and management strategies to this problem directly impact grower profits. Improvements in our understanding directly impact the success of future efforts in breeding for resistance. This project relied on careful breeding efforts to select for durable resistance. Our team has identified a

resistant gene that appears strong and durable. Additional discoveries of interest further support our hypothesis that the gene controlling root resistance is separate from the gene controlling tuber resistance. This is an important distinction, and will aid in future breeding efforts. *M. chitwoodi* costs the growers a great deal of money, and finding alternatives and management strategies to this problem directly impact grower profits. Improvements in our understanding directly impact the success of future efforts in breeding for resistance.

A direct measurable outcome of this project is the development of improved potato lines in a cv. Russet Burbank, cv. Desiree and breeding line PA99N82-4 background with resistance to *M. chitwoodi* and other root-knot nematodes. The possible employment of these lines under field conditions is a long-term project and cannot be completed within the timeframe of this study. Additionally, grower education tools about nematode were improved by developing and distributing high quality outreach cards for the three most important nematode pests of potato.

The long-term goal of this project was to reduce pesticide use to control root-knot nematodes in potato. In order to achieve a 10% reduction in pesticides, current management strategies need to be revised and new tools implemented. One such tool could be the cultivation of potato lines with transgenic resistance as developed in this study.

Project Objective 1. Results showed that a targeted reduction of pesticide to control nematodes in potato by 10% cannot be implemented or tracked within the timeframe of this study but is a long-term effort. This study set the stage for a revision of nematode control strategies by providing improved management and decision tools for growers.



Additional replicates of field and greenhouse assays were conducted to screen for nematode resistance. The functional characterization of *Meloidogyne* effector genes was moved forward by identifying and altering their plant binding partners. Moreover, nematode information cards were made available to growers and results shared at various grower meetings and through publications. We characterized the selectability penalty while using molecular markers to genotype the unselected progeny to improve parental selection for the crossing. We explored the hypothesis that 82-4 was damaged in 2012 because of the emergence of a new pathotype. This involved isolation of nematodes from damaged tubers, the establishment of pure cultures and the testing of host status on differentials and 82-4.

As shown in the above graph, the cultivar bearing the resistance gene was subjected to no chemical treatments, performed nearly as well as our standard chemical treatment with Russet Burbank. Our goal of establishing the resistance gene present in N82-4 as a potential fumigant replacement in the future was established by our data.

Our work suffered some significant setbacks due to a restructuring by the USDA-ARS and loss of key technicians and office staff during 2014. The greenhouse studies intended to evaluate how the resistance gene interfaces with temperature and environmental conditions proved inconclusive due to lapses in staffing. A complete data analysis is not yet finalized for all elements of the USDA-Prosser portions of the work, but the principle investigator plans to continue this work and offer it for publication in early 2015.

Project Objective 2. Experimental transgenic nematode-resistant plants were developed in cultivars Desiree and Russet Burbank, as originally proposed.

Project Objective 3. All three nematode information cards for growers and industry were developed and distributed to the Washington potato industry through the Washington State Potato Commission.

Other personnel changes affected the final stages of the grant. Jensen changed jobs in 2012, beginning a new role in the Northwest potato industry by creating the Northwest Potato Research Consortium, a cooperative research funding program by the potato commissions of Idaho, Oregon, and Washington. He is now based in the Boise, Idaho area. His outreach portion of the project was completed despite the new position. In summer of 2014, Elling (the lead on research and reporting for this grant) left Washington State University for a position in a private company in North Carolina. His aspect of the research had been completed at the point of his departure.

Prior to this study, no transgenic potato lines with resistance against root-knot nematodes existed. Potato RNAi lines were developed and were successfully tested against *M. chitwoodi* and other root-knot nematodes. Furthermore, previously available nematode outreach cards in the Pacific Northwest potato industry focused on insect pests. The education cards here are the first ones related to plant-parasitic nematodes that are available through the Washington State Potato Commission.

Historically it has been reported that it costs 20 million dollars to prevent 40 million dollars of damage. 10 to 15% of the cost of production is fumigation, so any advancement in nematode control is a direct gain to growers and has significant market impacts. At least 30% of the potato fields in Washington State need to be fumigated annually. The most costly elective treatment utilized by the growers each season is fumigation for nematode control. Our data suggest that growers may forgo fumigation of infected fields, and still meet quality and grade if using N82-4. This was a very significant finding. Unfortunately, some challenges remain in improving marketable qualities of N82-4. Hollow heart and growth cracks prove challenging in N82-4, these quality control issues must be addressed. However, there remains some interest in developing this variety to determine if the undesirable traits could be improved through classic breeding efforts. Furthermore, we enhanced our understanding of how the N82-4 genes react when under varied pressures, such as high heat. An important point to re-emphasize is that the traditionally bred N82-4 can be grown in nematode infested ground without fumigation. Also the nematode load in these fields is lowered considerably at the end of a single year of cropping N82-4. An important feature of the fumigant metam sodium is the removal of *Verticillium* as a yield lowering factor. N82-4 measures in the medium range for *Verticillium* resistance. Even without high resistance to *Verticillium* it is possible to recommend the omission of metam sodium. Future nematode resistant varieties should be also in the medium range of *Verticillium* in order not to have yield reduction from *Verticillium* if metam sodium is not used in fields with a history of *Verticillium* Early Dying Syndrome. The disappointing increase in incidence in 2012, which was a year with dramatically higher soil temperatures, should be considered in the context that the Disease Severity Index which was in fact quite low. Using industry standards for cullage untreated N82-4 still was an acceptable raw product despite the high percentage of tubers that had one or two infection sites.

To date, a *M. chitwoodi*-resistant breeding line that is close to commercial release has undergone several rounds of field tests. Additionally, a novel source of transgenic resistance using RNAi of nematode effector genes has been successfully implemented in potato cvs. Desiree and Russet Burbank and breeding line 82-4. Since these lines are not released yet, it is too early to evaluate their economic impact on potato production and the reduction of pesticide use. Information cards about the three main nematode pests have been distributed. Quantifying impact on grower awareness about nematode diseases is subjective, but positive reports of the usefulness of the project have been obtained by regional growers and processors.

BENEFICIARIES

This project impacts all of Washington's ~115 potato growing operations (50 acres or more). These beneficiaries were impacted immediately by increased understanding of plant-parasitic nematodes and will benefit over time by having access to integrated management tools that would allow them to reduce reliance on pesticides and fumigants to control *M. chitwoodi* and other root-knot nematodes.

Potatoes represent about \$500 million annual production value in Washington -- one of its most important crops. *M. chitwoodi* causes tuber quality defects and can lead to loss of marketability of entire fields if 5-15% of the tubers show excessive symptoms. Additionally, it is a quarantine pest, which inhibits trade with key export markets if shipments are infested. Consequently, it must be controlled in almost all fields. The alternative management approaches that can be developed as a result of this study, even if reducing chemical control by only 10% state wide, would save millions of dollars in production costs (about \$2.8 million in the case of replacing 10% of fumigant with resistant cultivars).

LESSONS LEARNED

In field trials, is difficult to consistently have 1,000 lbs of seed available for each season to test. The amount of staff and resources needed to complete a robust study on the temperature/gene interaction are greater than what is available at USDA-ARS Prosser. However, this work is important and should be completed in the future. A determination if treatment pressures are selecting for more robust nematodes in plots is needed and this interaction may be impacting field data.

A key message related to plant-nematode interactions is that disrupting the function of a single nematode effector gene through a transgenic approach can lead to very significant levels of resistance. It is important to note that this resistance is broad and is effective against a range of nematode isolates and species. Not all potato cultivars could be successfully transformed. Whereas Desiree, Russet Burbank and advanced breeding line PA99N82-4 could be genetically manipulated, Russet Ranger and Umatilla could not be transformed in this study.

Field plots showed very little early dying (*Verticillium*), which was highly unexpected. N82-4 performed so well without treatment. The data surprisingly reflected how well N82-4 consistently performed in field conditions. In 2012, N82-4 appeared to be more damaged than usual. This is assumed to be due to heat or the selection of a new virulence type of nematode. However, study of N82-4 should be continued in regional breeding programs.

Some potato cultivars could not be transformed and needed to be eliminated from the study. An important finding was that the resistance effect is epigenetically inherited by nematode offspring and even protects wild type plants.

ADDITIONAL INFORMATION

Cash matches:

Washington State Potato Commission (Jensen): \$2,401

Cash matches from WSPC to Dr. Jensen: Salary and benefits for Dr. Jensen to produce nematode outreach/extension cards: salary \$35.40/h, benefits \$5.05/h x 16h = \$647.20/card (3 cards total, 1 per year). Postage for mass mailing of 250 nematode outreach cards to potato growers (rest distributed upon request): \$0.61 x 250 = \$152.50 per year (1 card/year).

USDA/ARS (Brown): \$22,500 Cash match from WSPC (\$22,500): \$13,500 salary for Research Associate; \$4,725

benefits; \$2,250 chemicals; \$2,025 supplies.

In-kind matches: Washington State University (Elling): \$33,591 In-kind match from Washington State University to Dr. Elling: Unrecovered F&A for \$92,144 WSDA sub-contract budget: \$33,591 (standard rate 49.5%).

Peer-reviewed journal articles: Davis, L., Elling, A.A., and Brown, C.R. Calcium is involved in the R Mc1 (blb)-mediated hypersensitive response against *Meloidogyne chitwoodi* in potato. *Plant Cell Reports* (publication date pending).

Dinh, P.T.Y., Brown, C.R., and Elling, A.A. 2014. RNA interference of effector gene *Mc16D10L* confers resistance against *Meloidogyne chitwoodi* in *Arabidopsis* and potato. *Phytopathology* 104: 1098-1106.

Dinh, P.T.Y., Zhang, L., Brown, C.R., and Elling, A.A. 2014. Plant-mediated RNA interference of effector gene *Mc16D10L* confers resistance against *Meloidogyne chitwoodi* in diverse genetic backgrounds of potato and reduces pathogenicity of nematode offspring. *Nematology* 16: 669-682.

Dinh, P.T.Y., Zhang, L., Mojtahedi, H., Brown, C.R., and Elling, A.A. RNA interference of effector gene *16D10* leads to broad *Meloidogyne* resistance in potato. *Journal of Nematology*, submitted.

Patents: Elling, A.A. and Brown, C.R. (2014): Transgenic potato lines with RNA interference-mediated resistance against root-knot nematodes. Provisional US Patent 61948761

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PROJECT #16

Project Title: Spotted Wing Drosophila Management on Tree Fruits

Partner Organization: Washington State University Tree Fruit Research & Extension Center (WSU)

PROJECT SUMMARY

This project addressed control of a new invasive pest of US agriculture, the spotted wing drosophila (SWD), *Drosophila suzukii* Matsumura. The species was first identified in California in 2009, and detections occurred throughout the west coast in 2009-2010. Sweet cherries were identified very early as one of the high-risk crops for attack by this pest. This posed a threat to Washington's \$350 million sweet cherry industry, particularly for exported fruit. Quarantines were established for this pest by two of Washington's trading partners, Australia and New Zealand, which were not infested with this pest.

This pest was essentially unknown in the US and Europe at the time of first detection; all of the primary literature was in Japanese, where it was first named and studied. More recent literature on the ecology of the Drosophilidae, including *D. suzukii*, indicated that it thrived in warm-temperate climates, and was considered an unlikely candidate for invasion in the arid interior growing regions of the western US. Thus, this species was not expected to be a pest in interior (east of the Cascades) Washington, and no control recommendations were available. Growers and consultants needed to be alerted to the threat of this new pest, and take steps to control it with the information available.

The project was not built on a previously funded SCBGP project.

PROJECT APPROACH

Seasonal phenology of SWD - We monitored SWD during 2012 and 2013 using traps baited with apple cider vinegar (ACV), the accepted standard bait for this insect. Traps were deployed in eastern Washington from the Canadian border to the Oregon border, and checked weekly throughout the year. Bait was changed at each visit, and the contents of the traps retrieved and brought back to the lab for identification. WSU personnel counted the numbers of male and female *D. suzukii* present in the samples, separating them from other *Drosophila*.

The results of the regional trapping program were used as the basis for a regional alert system for SWD. The trap counts were uploaded daily to a website (<http://www.tfrec.wsu.edu/pages/swd>) and as each region caught its first fly, an alert was sent out via an email list. The first fly by region was also posted on the website in tabular and graphical form. In order to maintain confidentiality yet provide cooperators with information pertaining to their own orchards, a system was developed so that any user could generate a graph of trap capture over time by region, but by entering the trap code of the trap in their orchard, could track individual or groups of traps. The mailing list also provided updates on control information or trends in population levels.

Because of the trapping program, we are reasonably confident at this point of the seasonal pattern of abundance of SWD in eastern Washington. Adult densities are low during the winter, spring and summer months, rising in late summer, and peaking in autumn. High trap catches continue until killing frosts or continued sub-freezing temperatures inhibit adult activity. Cooler fall temperatures promote the development of a darker morph, which is adapted to survive the winter. If winter temperatures remain near or below freezing, trap catch is suspended; however, in the relatively mild winter of 2013, trap catch occurred in every month of the year, although at low levels during the winter.

Compare trapping systems for optimal use in large-scale monitoring of SWD. We participated (along with other research labs throughout the US) in testing trap designs for SWD. In 2012, this consisted of a trap color test, a surface area test, and a test of entry orientation (top vs side of the trap). In the Washington cherry studies, there were no differences among traps of different colors (cup traps in red, yellow, black, white, clear). Similarly, there was no increase in trap capture with increasing surface area of the bait. Entry orientation also did not alter the trap capture.

The national cooperative tests of trap design were abandoned in 2013 in preference for tests of new lures. Two numbered commercial lures produced by Trécé were tested in 2013. The two lures were deployed in conventional wet-bait style traps, either over water as the drowning fluid, or ACV. They were compared to yeast-sugar-water bait, a wine-vinegar-molasses bait, and ACV alone. The new Trécé lures over ACV caught the highest numbers of SWD, and also were the most sensitive (early capture at low densities). In 7 out of 7 orchards, one of the Trécé lures captured the first fly, and provided 1-4 weeks earlier capture than ACV. This higher level of sensitivity may allow the use of traps as action thresholds in individual orchards, rather than the regional level at which they are now used.

Determine the effectiveness of pesticides to prevent damage/infestation by SWD. Insecticide trials were conducted in 2012 and 2013. In 2012, materials were tested in programs that used each one at its label-specified preharvest interval and number of applications allowed within that time period. Warrior showed a drop in activity after 10 days after a single treatment. Mortality was higher in the two Entrust treatments, which were applied 3 times at 7-day intervals. The two formulations of Entrust (80W and 2SC) performed similarly.

A field-aged residue bioassay approach was used in 2013, but followed the residue decay curves of 7 pesticides over time. Fyfanon (malathion) residues caused high levels of mortality through 4 days after treatment (DAT); Sevin and Diazinon through 10 DAT, and Entrust and Delegate through 14 DAT. Fruit protection (oviposition and adult emergence) dropped off much more quickly. Rimon+Warrior provided high levels of mortality through 21 DAT, but the effect of Rimon on oviposition and emergence needs to be re-examined.

In addition to the test of multiple materials, a test of application method (handgun, airblast at 100 and 400 gallons/acre) was performed using a single material (Warrior). All methods provided similar levels of residual control.

Determine susceptibility of commercially produced fruits to SWD. The susceptibility status of tree fruits other than cherry was initially in doubt; however, it became clearer with time and field experience that cherries were the high-risk tree crop; apple and pear were not at risk, and stone fruits other than cherry were only considered at risk if they were past the firm-ripe stage, at which normal commercial harvest is conducted. Thus efforts were concentrated on pinpointing the stage of maturity at which cherries become susceptible. Tests in 2012 indicated that the cultivar 'Sweetheart' became susceptible when the background flesh color changed from green to light yellow, with the first appearance of a pink blush. This was confirmed in 2013, with only green fruit not susceptible to attack (early June). Three other cultivars showed the same trend, in that fruit that had changed to straw/blush became susceptible to attack. The degree of attack over the maturity period varied, and was not always consistent; but in one test, 'Sweetheart' fruits were more susceptible to attack 2 weeks before commercial harvest, and susceptibility declined during the post-harvest period.

The partnership with the tree fruit industry consultants was key to the success of the first objective, tracking the seasonal phenology of SWD. A group of core traps (about 40) was checked by WSU personnel, but the rest (ca. 150) were retrieved by volunteers, and delivered to the WSU-TFREC for counting.

The other partner (WSDA Inspection Service) enabled the determination of outcomes of SWD control practices. Inspectors were given culture tubes filled with *Drosophila* medium, and transferred larvae found in crush samples to the medium for rearing out. These were delivered to the WSU-TFREC (if found in the Wenatchee district, or to the WSDA Yakima office if found in the south), and the fate/species identification of each specimen was posted on a website shared with the WSU and WSDA.

The SCRI-SWD grant (in addition to supplying funding to help support detection and monitoring) has provided access to a larger research community working on SWD. Sharing information has helped move the entire team ahead, and allowed the most efficient use of resources.

No other commodities benefited from this research.

GOALS AND OUTCOMES ACHIEVED

1. Producing cherries free from SWD infestation. The grant's objectives were designed to provide the underlying knowledge on SWD biology and management so that growers could control this pest effectively. Understanding seasonal abundance, monitoring, fruit susceptibility in relation to fruit maturity, and effective use of pesticides all contributed to this end. The partnership with the WSDA has been a very successful independent and industry-wide measure of how well the control measures are working. Our benchmark for the number of *Drosophila* finds in packinghouse inspection samples was 29 larvae in 2010. In the first crop season of the project (2012), this number dropped to 11 *Drosophila* larva recorded by the WSDA (6 confirmed SWD, others not identified). In the second crop season (2013), the number went up considerably: a total of 46 samples were recorded (some with multiple larvae) for a total of 43 SWD larvae. Only 1 of the identified larvae was a different species of *Drosophila*, a clear indication that this was the primary problem species. The 2013 crop year posed some severe weather challenges, with multiple rain and hail events, and the difficulty in applying sprays and keeping residues viable was evident in the packinghouse samples.

2. Research based pesticide information. Both field and laboratory trials have contributed to the knowledge base of SWD control. Laboratory bioassays provided more precise information on rates and mode of action of various pesticides; if initial laboratory screening indicated that the compound in question had little potential value, it was dropped from further testing. The field efficacy trials contributed to our knowledge of how effective the pesticides were against SWD, and how long residues would last under field conditions. All Recommendations were posted on the SWD website.

3. SWD website for eastern Washington. This website was the major vehicle for communicating real-time results on SWD phenology and abundance throughout the eastern Washington growing region, as well as recommendations for control. The website was built on the precept of making changes in current status readily accessible, while still providing links to the broader world of research and extension on SWD. An additional priority was allowing users access to the underlying trapping database, while maintaining confidentiality of individual enterprise, a matter of considerable concern at the beginning of the grant.

The goal of having low numbers of *Drosophila* finds in packinghouse inspections is both a short- and long-term goal, whose success can be measured every season. It has become clear that even with accurate knowledge of effective pesticides and spray intervals that damage can occur for a variety of reasons. The population pressure from SWD in 2013 was higher than in previous years; it is difficult to forecast whether this will be the norm. However, the general principle that mild winters will promote higher populations seems a reasonable conclusion. Another factor is the weather during the fruit maturity period: poor application conditions (wind, rain) will hinder pest control activities, regardless of the intended program for control.

For the most part, the activities conducted under this project were the same as in the original grant. There were a few exceptions, however, that could not have been anticipated with the knowledge in hand at the time the grant was written. Because SWD is a direct feeding pest under quarantine by several countries, commercial growers were reluctant to participate in field trials that included a check, thus no cooperators of this type were found. The field pesticide trials that were planned in the WSU research orchard were re-configured to field-aged residue bioassays because no 'natural' insect pressure occurred in this block during the 2 years of study. This occurred despite repeated releases of laboratory-reared flies to increase populations. WSU's control recommendations for SWD are still considered 'provisional' because of this lack of field data. A proof-of-concept trial of releasing flies into whole caged cherry trees was used for one of the timing of susceptibility studies, and was found effective. Only a single study was done in this format due to the limited number of cages available.

The original plan was to investigate all commercial tree fruits, but cherries were chosen as the highest priority target. Pome fruits were essentially eliminated from the pre-harvest host list, and the non-cherry stone fruits were being investigated under a separate grant funded by FAS-TASC.

The trapping program, which elucidated seasonal phenology and provided data for the regional alert system, all occurred as projected. Because of these two years of trapping (in addition to the previous 2) the pattern of seasonal abundance of SWD in eastern Washington appears to be consistent. The tests of trap types and baits/lures were also successful, and provided insights into trap configuration that can be incorporated into future trap/bait systems.

1. *Eastern Washington cherry growers will produce crops free from infestation by SWD.* The baseline was 29 *Drosophila* larval finds by the WSDA inspection service in 2010. Larval finds were successfully reported and identified in 2012/2013; in 2012, the number of larvae found (11) was lower than the benchmark, but higher than the target of 5 or few finds. In 2013, the number was 46, considerably higher than the previous year. This pest has proven more difficult to control under some conditions than anticipated; in addition, a tolerance exists for low levels of infestation except for export countries with quarantines.

2. *Develop research-based crop-specific pesticide recommendations for control of SWD on sweet cherries in eastern Washington.* The targeted replicated field trials were not performed, except as bioassays of field-aged residues (see above). However, information from these bioassays, along with relevant information from other cherry-growing regions, were transmitted to growers at meetings and on the website.

3. *Develop and maintain a website that provides real-time information on SWD phenology and control.* The SWD website <http://www.tfrec.wsu.edu/pages/swd> was developed and maintained as proposed, with email alerts sent at the appropriate times. The mailing list has ca. 120 members (less than the target 200), but likely comprise all the persons who would benefit by this information. This page has been accessed >9,000 times, indicating active use during cherry season.

BENEFICIARIES

Washington's sweet cherry industry has been the primary beneficiary of this project. Although only a few years post-invasion, producers and consultants now have the basic tools (as well as an idea of their limitations) to control this new pest. Internal fruit pests are generally classed as the most injurious type, and the inability to control them can have serious economic consequences; infestation levels over a certain point will cause rejection of the entire load of fruit, because of the inability to sort out infested fruit.

The economics of insect control is that of preventing losses; if the loss did not actually occur, one can only estimate what might have occurred in the absence of control measures. Initial estimates of losses to sweet cherries (Walsh et al. 2011, J. Integrated Pest Mngmt 2(1)) placed the potential at 20% crop loss, or \$57.8 million for Washington's cherry industry. While not all of this loss was prevented in 2012/2013, a reasonable estimate is that only 0.3 – 1.4% of the possible losses occurred.

LESSONS LEARNED

The lesson learned from one of the project goals not being met (preventing infestation from SWD) is that despite having adequate tools and information to prevent infestation by SWD, other factors such as weather, tree architecture, crop load, and market influence the grower's interest or ability to control SWD. For example, multiple rain events in 2013 contributed to fruit cracking; the light crop was marginal to warrant harvest in many orchards, and some growers abandoned their crops without harvesting them. This, along with the mild winter temperatures, may have led to a significant increase in pest pressure. Sequential harvesting of multiple varieties in the same block also leads to prolonged harvest periods where pesticide use must be suspended; this will continue to be a challenge for varieties requiring pollenizers.

Another unanticipated difficulty was establishing an SWD population in the research orchard, despite multiple attempts to do so. This may become established over time due to better establishment of the pest in general, or possible a more mature canopy will provide a more suitable habitat for SWD. The constraints in finding a willing commercial cooperator include paying for crop loss, or predicting which orchard will have a problem in any given year.

The most unexpected outcome was the massive fall captures of adults in ACV traps. Normal annual cycles of insect abundance are characterized by declining abundance as the daily temperatures and daylength decline. In addition, many insect population densities experience a burst of activity in the spring in response to warmer temperatures and increasing daylength. The pattern for SWD is essentially the opposite of this.

Absent a new pesticidal solution to SWD, changes in horticultural practices may alter the likelihood of SWD infestation. Using self-fertile varieties will obviate the need for extended harvest periods in a single block. Smaller trees with more open canopies should enhance spray penetration and coverage, and drier conditions (less shade, lower relative humidity) appear to be less hospitable to SWD.

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ADDITIONAL INFORMATION

The cash match of \$36,816 came from the Washington Tree Fruit Research Commission (an industry-funded granting agency). The additional dollars helped expand the numbers of traps deployed in the regional monitoring program, and this allowed a more extensive series of bait and trap tests. The in-kind donation of consultants took the form of collecting trap samples throughout the state. Volunteers collected ca. 2,000 trap samples per year, or an estimated value of \$10,000. The unrecovered indirect cost (WSU) covers the use of WSU office, laboratories and research orchards.

Journal articles:

Beers, E.H., Van Steenwyk, R.A., Shearer, P.W., Coates, B., Grant, J.A., 2011. Developing *Drosophila suzukii* Management Programs for Sweet Cherry, *Pest Manag. Sci.* 67, 1386–1395.

Haviland, D., Beers, E.H., 2012. Chemical control programs for *Drosophila suzukii* that comply with International limitations on pesticide residues for exported sweet cherries. *Journal of Integrated Pest Management* 3.

Lee, J.C., Burrack, H.J., Barrantes, L.D., Beers, E.H., Dreves, A.J., Hamby, K., Haviland, D.R., Isaacs, R., Richardson, T., Shearer, P.W., Stanley, C.A., Walsh, D.B., Walton, V.M., Zalom, F.G., Bruck, D.J., 2012. Evaluation of monitoring traps for *Drosophila suzukii* (Diptera: Drosophilidae) in North America. *J. Econ. Entomol.* 105, 1350-1357.

Lee, J.C., Shearer, P.W., Barrantes, L.D., Beers, E.H., Burrack, H.J., Dalton, D.T., Dreves, A.J., Gut, L.J., Hamby, K.A., Haviland, D.R., Isaacs, R., Nielsen, A.L., Richardson, T., Rodriguez-Saona, C.R., Stanley, C.A., Walsh, D.B., Walton, V.M., Yee, W.L., Zalom, F.G., Bruck, D.J., in press. Trap designs for monitoring *Drosophila suzukii* (Diptera: Drosophilidae). *Environ. Entomol.* 42.

Abstracts:

Beers, E.H., 2011. Shock and awe: A narrative history of spotted wing drosophila in west coast sweet cherries, Pacific Branch of the Entomological Society of America, Waikaloa Hilton, Kona, HI [Abstract].

Beers, E.H., Smith, T.J., Walsh, B.D., 2011. Spotted wing drosophila in Eastern Washington, 2010, 85th Annual Western Orchard Pest & Disease Management Conference [Abstract], Hilton Hotel, Portland, OR.

Beers, E.H., Smytheman, P., Greenfield, B.M., 2012. Spotted Wing *Drosophila* in Eastern Washington: 2011 Update, Abstracts of the 86th Annual Orchard Pest & Disease Management Conference, 2012, Portland Hilton, Portland, OR.

Beers, E.H., Walsh, D., Smith, T.J., 2013. Spotted Wing *Drosophila*: Year 3 in Eastern Washington, 87th Orchard Pest and Disease Management Conference, Hilton Portland, Portland, OR.

Haviland, D.R., Beers, E.H., 2012. SWD and MRLs: Controlling One While Complying with the Other, Abstracts of the 86th Annual Orchard Pest & Disease Management Conference, 2012, Portland Hilton, Portland, OR.

Shearer, P., Beers, E.H., Brown, P., Burrack, H.J., Isaacs, R., Lee, J., Miller, B., Novotny, L., Van Timmeren, S., Van Steenwyk, R., Walton, V.M., Wise, C., 2012. *Drosophila suzukii* in the USA; monitoring and management in berries and cherries, IOBC/WPRS Pheromone Group: Semiochemicals: The essence of green pest control, Bursa, Turkey.

Shearer, P.W., Van Steenwyk, R.A., Bruck, D.J., Beers, E.H., Tanigoshi, L.K., 2012. Spotted Wing *Drosophila*, a New Berry and Cherry Pest in the Western USA, International Congress of Entomology, Daegu, South Korea.

PROJECT #17

Project Title: Washington State Clean Plant Campaign

Partner Organization: Washington Wine Industry Foundation (WWIF)

PROJECT SUMMARY

Grapevine viruses were identified by industry stakeholders, including growers, processors and WSU scientists to be a principal threat to the economic sustainability of the grape and wine industry. Technological advancement in testing for viruses had revealed virus presence in certified nursery mother blocks, the source of propagation materials for certified nurseries and previously believed to be a reliable and safe source for clean grapevines. Since viruses are spread through propagation of infected plant materials, clean planting stock is vital. Industry stakeholders quickly recognized viruses had likely gone undetected, had already spread through propagation and were in newly planted and established vineyards. It was essential to the long term sustainability of Washington's wine and grape industry that all mother blocks be tested for virus presence and the industry as a whole become informed about virus detection, prevention, control, and the importance of using clean, virus-free grapevines for vineyard establishment.

Grapevine viruses affect grape quality, quantity, and vineyard longevity. Fruit produced from virus infected vines has less sugar, fewer pigments, and reduce "mouth feel", an important component of wine. Infected vines also produce less fruit and have a 50% shorter life span. These issues can severely affect the economic sustainability of Washington's \$8.6 billion grape and wine industry.

Additionally, Washington was and is experiencing rapid expansion in wine grape vineyard establishment. A reliable source of clean, virus-free plants is essential to meet the 5 percent annual growth in acreage projected for the next several years. The only way to ensure the availability of clean, virus-free plants to meet this need was to sample all certified mother blocks, the source of current and future vineyards in Washington and the Pacific Northwest, and develop a strategy for detection and remediation.

This project did not build on previously funded specialty crop block grant projects.

PROJECT APPROACH

The project approach was twofold.

- 1) Collect samples of all certified mother blocks in the state and sample for virus presence.
 - Mother blocks were mapped
 - Sampling strategy was developed for WSDA inspectors to ensure samples are consistent, representative, and appropriately taken for testing with advanced laboratory equipment (RT-PCR). A composite sampling consisting of leaf samples from four adjacent grapevines along each row was followed.
 - Over 2,900 composite samples representing almost 12,000 plants were taken from 6 certified nursery mother blocks and tested using RT-PCR. Additionally 700 samples were provided for testing by concerned growers.

The presence of viruses was found to vary by grape variety. During the 2nd quarter of 2012 on a test of 1,179 composite samples representing 4,716 mother block grapevines, the following levels of GLRaV-3 and GRSPaV were detected:

<u>GLRaV-3</u>	Infection Level	<u>GRSPaV</u>	Infection Level
Cabernet Sauvignon	2.9%	Semillon	14%
Chardonnay	15%	White Riesling	63%
Syrah	8%	Sauvignon Blanc	12.5%
Zinfandel	8%		
Merlot	12%		
White Riesling	3%		

- September 2014 – New rules for Washington’s grape quarantine, regulated pests and certification were adopted strengthening Washington’s ability to prevent introduction of viruses and other pests.
- During the grant period 3 nurseries dropped from the certification program.

2) Conduct an education and outreach campaign to increase awareness about the risks of planting virus infected plants and promote planting of materials known to be free of viruses.

A comprehensive education and outreach campaign was developed and directed at stakeholders including growers, wineries, vineyard employees, and nursery inspectors.

- 3 summer tours with focus or had a component related to clean plants.

Topics included virus detection, risks of planting virus infected grapevines, impacts on vine health, fruit quality, wine quality, and ultimate effect on sustainable growth of the grape and wine industry, why and how mother blocks are used to prevent viruses, and management of virus vectors.

August 2012 – Focused on clean plants and attended by 60, 90% of respondents to post survey reported learning new information about testing, protocol, NCPN organizational structure. 80% reported learning new information about clean plant infrastructure.

August 2013 – Multiple components and attended by 59, 47% attended for the purpose of learning about best practices for grape growing, the portion of the program which included a presentation about mother blocks, virus prevention, and virus vectors.

August 2014 – Conducted in Spanish and targeted vineyard managers and employees. Attendees ranked their level of knowledge about viruses and clean plants at 2.9 before the tour and 3.7 at the conclusion of the tour on a scale of 1 to 4 (with 4 being the highest).

- 3 Educational Conference Sessions

February 2013 - “The Human Element in the Dynamics of Grapevine Leafroll Disease” was presented during the General Session at the 2013 Washington Association of Wine Grape Growers Annual Meeting, Convention and Tradeshow on February 6 by Dr. Neil McRoberts, Plant Pathology Department, UC Davis with over 350 people attending.

February 2014 – “Seeing Red: When Old Prevention Techniques Result in New Disease Outbreaks.” 136 people pre-registered for the session and open walk-ins (no formal counts were taken) boosted attendance to the 3 ½ hour session. The session targeted growers, winemakers, crop consultants, and nurseries and included presentations from national experts on grapevine viruses, producers, and an economist.

Post event evaluations indicate 66 percent of those attending were growers and another 22 percent were growers also owning a winery. Prior to the session, 36 percent felt they were somewhat familiar, 46 percent were familiar, and 18 percent were very familiar with grapevine viruses. 100 percent of attendees reported gaining greater understanding of the subject as a result of attendance.

December 2012 - Workshop “Vine to Wine – How Grapevine Leafroll Disease Affects Grapes & Wines” Topics included impacts of Grapevine Leafroll Disease on vine health, quality, yield; sampling and virus protocols; visual impact of leafroll disease on grape clusters, blind tasting of wine from infected and healthy plants, impact of grapevine leafroll virus on wine quality.

The workshop was attended by 56 members of the wine and grape industry and included representation from growers, winemakers plus some service and supplier providers (nurseries, etc.).

A post workshop evaluation indicated attendees who felt well-informed about grapevine leafroll disease at the conclusion of the workshop was almost three times greater than those who felt well-informed before the workshop. Attendees were asked to rate their own knowledge level (from 0 to 4, with 4 being highest level of knowledge) before and after the workshop in four categories: knowledge of grapevine leafroll disease in general, symptoms, diagnostic protocols, and effect on yield and fruit quality. Results of the evaluation show attendees felt they at least doubled their knowledge in all categories and grew their knowledge of diagnostic protocols by three and one-half times.

- Three workshops were held for WSDA nursery inspectors

Topics included observing virus symptoms, field diagnosis, how viruses are spread, vectors, prevention of spreading through use of virus tested grapevine materials, protocols for taking samples when virus is suspected, and monitoring nurseries for viruses at different times during the growing season.

June 2012 – Attended by three nursery inspectors, led by WSU grape virologist

June 2013 – Attended by two nursery inspectors

June 2014 – Attended by 10 nursery inspectors and 2 supervisors

- Short presentations

15 one-on-one meetings on-site at vineyards were conducted to review virus diseases, diagnosis and management with wine grape growers.

June 2013 – “A Leafhopper-Transmissible Geminivirus is Present in Grapevines Showing Redleaf Symptoms,” a poster authored by Sudarsana Poojari, Olufemi Alibi, Viacheslav Y. Fofanov and Naidu A. Rayapati was presented at the 64th American Society for Enology and Viticulture National Conference.

September 2013 - New findings about the virus Red Blotch were presented at the Grape Fieldman’s Breakfast.

September 2013 - Presentations about current status of virus diseases in Washington vineyards and the Clean Plant Campaign were presented at the WERA Annual Meeting.

- Media

December 2011 – Article published in the Good Fruit Grower about the Clean Plant Campaign

September 2013 – Article about clean plant availability shortage was published in the online WAWGG newsletter News Bites.

- Materials developed, purchased or printed for continued educational outreach and education purposes
 - *Why ‘Clean’ Plants?* – 4 page, full-color brochure about impacts, prevention, diagnosis and testing for viruses was developed and printed.
 - *Porque Plantas “Limpias”?* – Spanish translation of *Why ‘Clean’ Plants?* was developed and printed.
 - *La enfermedad del enrollamiento de la hoja de parra* – WSU publication EB2027ES, Grapevine Leafroll Disease was reprinted in Spanish with permission from WSU.
 - *Guide to Clean Plants and Quarantines for Grapes in Washington State* was developed – 70 page, full color pocket guide about Washington’s quarantine, the pests under quarantine and other regulated pests.
 - A section about virus diseases was written for the *Field Guide for Integrated Pest Management in Pacific Northwest Vineyards: Pocket Version*, editors Michelle M. Moyer and Sally O’Neal – Bilingual guide was purchased for distribution at ongoing educational workshops.

Washington Association of Wine Grape Growers – provided ongoing support for this project by distributing information, providing educational venues, and coordinating educational programming.

Washington State University – Dr. Naidu Rayapati, Michelle Moyer, and others – Provided facility, equipment, staffing for ongoing testing of mother blocks, participated in the development and presentation of educational programming and educational materials.

Washington State Department of Agriculture – Improved training for nursery inspectors, and with stakeholder input, revised Washington’s quarantine and regulated pests to prevent introduction of viruses and other pests into Washington.

NW Foundation Advisory Group – Provided ongoing stakeholder guidance and expertise. Only specialty crops benefited from this project.

GOALS AND OUTCOMES ACHIEVED

1) Goal: Collect samples from mother blocks in all certified nurseries during 2012 and 2013 crop seasons, test by RT-PCR for grapevine viruses listed in standard virus indexing programs. Mother blocks will be monitored during the season for visual symptoms of grapevine leafroll, fanleaf and other viral diseases. Methodologies for the detection of different viruses will be noted.

- Scientific strategy for grapevine virus sampling was developed and implemented.
- WSDA nursery inspectors received training about viruses symptoms, detection, and taking samples for testing.
- During the grant period, over 2,900 samples were taken from 6 mother blocks. This is in comparison to a single sample from a mother block being submitted for testing in 2010.
- An additional 700 samples suspected for grapevine leafroll were submitted by growers and tested for GLRaV-3, GLRaV-4, and Grapevine red blotch-associated virus (GRBaV).
- All composite samples were tested using RT-PCR and retested to confirm specific plant affected to facilitate removal of virus infected vines. The results formed a foundation for developing future strategies to advance clean plant campaigns in Washington State.

2) Goal: Increase awareness among growers of the risks of planting “dirty” virus infected plants or those of unknown source, and drive demand for clean plants.

- 3 day-long tours, 3 conference sessions, 15 one-on-one meetings with growers, 4 short presentations, 2 media articles and 4 publications were developed, published or provided under this project. Follow up surveys to tours and conference sessions indicate knowledge and awareness gained.

Some measurable outcomes are expected to occur after the grant period. The case for using clean plants has been made and the awareness this there, but actual adoption may be thwarted by a limited supply of certified clean plants.

1) Goal: Collect samples from mother blocks in all certified nurseries during 2012 and 2013 crop seasons, test by RT-PCR for grapevine viruses listed in standard virus indexing programs. Mother blocks will be monitored during the season for visual symptoms of grapevine leafroll, fanleaf and other viral diseases. Methodologies for the detection of different viruses will be noted.

All activities in relation to accomplishing this goal were completed to the degree possible. At the onset of the grant period, expectations were to sample all certified mother blocks at the 6 certified nurseries. During the grant period, 3 nurseries dropped out of the state certification program. 6 certified nursery mother blocks at 3 nurseries were sampled during the grant period. A composite sampling strategy was used to determine the sanitary status of these mother blocks and develop an action plan for maintaining virus-tested vines in these mother blocks.

2) Goal: Increase awareness among growers of the risks of planting “dirty” virus infected plants or those of unknown source, and drive demand for clean plants.

Surveys taken following individual educational sessions show that awareness and knowledge about grapevine viruses, how they are spread, methods and reasons for control, and the benefits of using clean plants has increased following attendance to educational sessions. Pre-campaign and post-campaign survey responses indicate changes in actual behavior towards purchasing only certified virus-free plants for vineyard establishment will occur. Post survey responses indicate a 22% increase in the number of growers who will wait to plant until certified plants are available in their chosen variety or will chose to plant another variety which is available with certified status.

However, post-survey responses also indicate more growers are turning to self-propagated grapevines. While certified nurseries remain the overall first choice for plant acquisition, there is a 6% increase in the number of growers who indicate self-propagation as their first choice in post-campaign survey. We believe this is due to a significant shortage of certified plants from nurseries in the face of a rapidly growing demand for Washington grapes. Interestingly, obtaining certified grapevines from an out-of-Washington state nursery was the second choice for plant materials before campaign. At the conclusion of the campaign, out-of-state nursery sourced certified plants has been replaced by self-propagated plants. It is believed wine grape production will need to increase 5% annually to meet demand over the next 5 years.

A 12 question pre-campaign survey was sent to growers, growers with wineries, and wineries prior to the start of the campaign. The same survey was distributed to the same audience at the conclusion of the campaign. While the questions were appropriate in normal circumstances, we feel answers to the post-survey are affected by the period of rapid growth in the industry and the shortage of certified plants.

Our benchmark was to increase awareness of virus disease management practices among grape growers by 25% at the end of the project. When comparing the results of the pre-campaign survey and the post-campaign survey, there was a 21% increase in the numbers of people ranking their level of knowledge about virus disease symptoms at 5 to 7 on a scale of 1 to 7, with 7 being the highest level of knowledge. Awareness about grapevine leafroll virus increased by 1% and awareness about grapevine fanleaf virus increased by 46% on the same scale.

BENEFICIARIES

Grape growers, vineyard managers, vineyard employees, winery owners, winemakers and state nursery inspectors will all benefit from the clean plant effort. Through detecting, preventing, controlling, and eliminating grapevine viruses, improvements in fruit quantity and quality, vineyard longevity, and wine quality can be expected.

In 2013, the Washington Association of Wine Grape Growers reported 51,000 acres of wine grapes. In dollar terms, using an average price of about \$1,000/ton (USDA-NASS), an average yield of 4 tons/acre (WAWGG) on 51,000 acres of wine grapes, and a conservative estimate of 10% loss in yield due to viruses, an estimated annual loss of yield can be calculated at nearly \$20.5 million for red grapes alone. This staggering figure accounts only for losses of yield. Additional losses can be expected as a result of wineries paying lower prices for fruit of lesser quality produced on infected vines.

LESSONS LEARNED

This project directly points to the value of industry, research, extension, and regulatory agencies cooperating and working together. This project could not have reached its goals without the collaborative effort.

Terminology surrounding clean plants is not uniformly adopted across the research and extension community. For example: there has been discussion of the use of the words “infected” and “affected” and which word is most appropriate and when.

This project has confirmed the need for a national effort for clean plants and harmonizing standards.

Testing by RT-PCR revealed actual virus infection to be more extensive than previously believed. Nurseries are working to clean up and prepare for the future. Symptom-based diagnosis is not reliable, especially in white-fruited cultivars. The use of reliable diagnostic assays is essential for maintaining clean plants in certified mother blocks.

Forces or conditions beyond control, such as rapid expansion, shortage of materials, or high demand, may influence ability to achieve goals and/or measurable outcomes.

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ADDITIONAL INFORMATION

Matching funds:

Washington State University, \$97,358 for staffing, testing, and expertise

Northwest Foundation Block Advisory Group, \$15,000 in support for 4 meetings over 2 years.

Washington Association of Wine Grape Growers, \$2,800 for speaker fees, travel, and venue rental, \$7,500 staff time (100 hours @ \$75) for meeting organization, coordination, and outreach.

PROJECT #18

Project Title: Regulations and Strategies for Direct Marketing Specialty Crop Businesses

Partner Organization: WSDA Food Safety & Consumer Services Program

PROJECT SUMMARY

Small farms have diverse specialty crop production in order to maximize direct marketing opportunities and manage risk. These small farm businesses manage production, marketing, labor, and accounts with only 1-20 staff. This size farm is the fastest growing scale of production in Washington. Value added processing of specialty crop products help to diversify small farms and create new small business related opportunities in areas such as food processing, nursery stock, seed products and organic production. As these innovative, specialty crop farmers begin or expand their enterprises to meet market trends and stay viable; finding and understanding the food safety rules and regulations as well as direct marketing support can be difficult with limited resources when already wearing so many hats in day-to-day operations.

The WSDA Handbook for Small and Direct Marketing Farms: Regulations and Strategies for Farm and Food Businesses (Handbook) can meet that need, however with changing trends and new legislation annually; updates are required to keep it a useful resource for the 35,000 small farms and new venture business startups in our state. Several topics have developed since writing the 2010 edition. New regulations have been enacted and farmers and food processors need them clarified for specific practices and methods for compliance. The Handbook is a project that encompasses more information than what WSDA staff manages in program responsibilities and requires additional grant resources to make it happen.

A portion of the food processing equipment and facility construction design information that was incorporated into the food processing fact sheet was developed by the Value Added Specialty Crop Block Grant project completed by WSDA in June 2013.

PROJECT APPROACH

WSDA proposed to write 8 new fact sheets and almost doubled our deliverable with 15 new fact sheets. While these fact sheets were requested and needed by specialty crop farmers, the additional time it took to develop them pushed back the delivery date for the hard copy Handbook substantially, then delaying the photos, videos, and website, in turn.

However, from October 2013 to September 2014, WSDA presented fact sheet information at 4 farm conferences, and 10 farmer education classes. We reached 486 farmers directly, while our partners reached an additional 400-500 with the fact sheets as they were released, as well as an additional 2,640 farmers with the Handbook itself. Online reach will be measured after the grant period since the web site launching was delayed into mid- October 2014.

Results include farmers changing practices to comply with regulations. Farmers increasing their sales by starting new enterprises and diversifying their specialty crop products due to clearer, accessible regulations. Reducing market barriers as local health departments and buyers can more clearly enforce the actual regulations when the gray areas are reduced. And WSDA's clarification on salad green regulations for planting and production enables more farms to grow and market high demand salad greens safely and legally. One farmer wrote that the salad green regulation clarification alone is worthy of an award!

Project partners were many including public, private and our own agency experts. Programs within WSDA who offered technical information within a myriad of deadlines were Office of Compliance and Outreach, Food Safety, Nursery Inspection, Seed Inspection, Organic Food and our Communications Office.

Public Sector partners included the Washington State University Small Farms Team, Tilth Producers of Washington, Washington State Departments of Health, Revenue, and Labor & Industries, USDA Farm Service Agency and USDA Risk Management Agency.

Private sector partners included farm finance companies, and *most importantly, farmers to ground truth the fact sheet information and serve as models for best practices in the online photos and videos.*

Some information covered in the Handbook was minimally updated that covers four non-specialty crops and WSDA was able to utilize supplemental funding (not specialty crop block grant funding) to complete that work. In addition, Washington State's legalization of recreational marijuana required mention in both *Selling Nursery Products* and in *Selling Herbs*. Again, WSDA used supplemental funding to cover that work.

GOALS AND OUTCOMES ACHIEVED

WSDA wrote, published and distributed the *Handbook for Small and Direct Marketing Farms: Regulations and Strategies for Farm and Food Businesses* containing 41 fact sheets on direct marketing best practices and direct marketing regulations. Videos highlighting lesser known regulations and changes for seed production, food processing, nursery licensing, direct marketing, and salad greens were created. WSDA also took professional photos of direct marketing farmers, farms, facilities, products, and product labels to use as fact sheet legal examples and best practices. In addition, we created an online Handbook at www.agr.wa.gov/farmfoodbiz containing the fact sheets as PDFs with 200 photos and 15 video examples matched to fact sheet topics.

Long term goals included an increase of \$500,000 in 2013-2014 specialty crop sales. Through Washington State Farmers Market Association (WSFMA) preliminary data being analyzed at the time of this final report, a potential increase of 4.2% in overall sales from 2012-2013 is being seen. Of all WSFMA farm vendors 69% grow and sell specialty crops. Total farm sales in 2013 are \$25,422,125. While, this is not a direct correlation, it infers growth that substantiates an increase in specialty crop sales close to the projected \$500,000 increase. However the WSFMA data analysis is not yet final.

Proposed

Potential Impact

Small and mid-size specialty crop producers will benefit by accessing key information at their convenience and making better business decisions that increase their viability. The target audience is 2,500 specialty crop farmers during the grant period. Growers will receive the publication in hard copy or online in year two of the project. WSDA estimates that each of the 2,500 specialty crop farmers will benefit from at least a \$200 increase in sales from the information made available through these resources (\$500,000). Assisted sales and program impact will be tracked. This project addresses both the Marketing/Promotion and Education funding priorities.

Expected Measurable Outcomes

New specialty crop fact sheets and user-friendly online formats will increase sales of small-scale specialty crop producers in Washington.

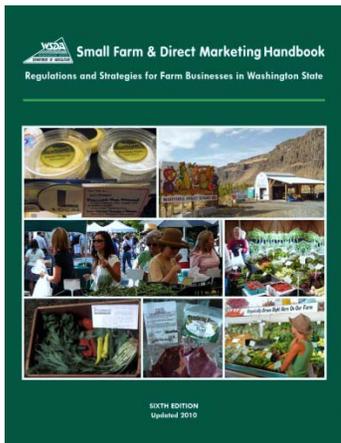
Goal: Increase informational access and farm viability for small-scale specialty crop farmers.

Target: 2,500 specialty crop farmers will be reached with new Handbook with sales impacts of \$500,000 in 2013-2014.

Benchmark: Will utilize current numbers of Handbook requests and downloads against new release; an online survey will provide sales benchmarks.

Performance Measure: Will utilize a database to enter and track Handbook requests, Handbook downloads, and an online survey for Handbook users and to measure sales impacts.

Baseline Data:



Feedback about the WSDA’s “Small Farm Direct Marketing Handbook”

This spring we asked for feedback on the WSDA’s “Small Farm Direct Marketing Handbook” (aka the Green Book)¹. With support from a Specialty Crop Block Grant, we’re working on a new update and wanted to know what farmers, processors, ranchers, extension educators, health and food safety officials, students, and buyers liked and what needed to be improved, updated, and added.

Thanks so much to each of you who took the time to respond. We greatly appreciate your feedback and look forward to integrating your comments into the next edition – due out this fall. Below is a summary of what you told us.

If you have any further comments on how we can make this resource better, please don’t hesitate to email me at pbarrentine@agr.wa.gov or call 360-902-2057.

WHO WE HEARD FROM

114 people • 70% were women • approximately 93% had at least some college
 30 out of 39 counties were represented
 22% of respondents were from King County followed by Clark & Thurston Counties

KEY THEMES & FEEDBACK

Handbook Format:

- There was strong support for continuing to print a hard copy and also having an online version available.
- Have one set of page numbers for entire document
- Improve the Table of Contents
- Add an Index and make the Handbook “searchable”
- Create internal links to other fact sheets
- Include photo examples
- Translate into Spanish

Willingness to Pay for the Handbook: Only 84% said they would be willing to pay for the hard copy of the Handbook. Most (almost 90%) selected an amount under \$15.

The **Specific Sections** that received the most comments were:

- Networks for Washington State Farms
- Licensing
- Taxes
- Direct Marketing in WA State
- Selling Directly to Consumers
- Selling Fresh Fruits and Vegetables
- Selling Eggs

The **Specific Sections** that received the most “excellents” were:

- Selling Fresh Fruit and Vegetables
- Selling Eggs
- Selling Mushrooms
- Selling Poultry
- Selling Beef, Pork, Goat etc

Suggested topics: There was a clear request for more information on GAPs, the new Food Safety Modernization Act and the new Cottage Food Law.

¹ A SurveyMonkey link was emailed to a variety of listservs.

Educational format: There was a strong preference for fact sheets, followed by classroom workshops.

Are you a data hound and want more details? Please contact Patrice.

Thanks again to everyone who did the survey! If you have any lingering suggestion, we'd love to hear it this summer while we're working on the updated version.

See you at the Tilth and Focus on Farming Conferences in November with new copies of the Green Book!

BENEFICIARIES

Those who have benefited from the completion of this project and its accomplishments include:

- Specialty crop producers in Washington State
- WSDA staffs handling phone calls and requests for technical assistance information now have a revised Handbook that helps to direct inquiries to various WSDA program areas. Over 35 Food Safety Officers were provided copies of the Handbook at their October 2014 program meeting as an updated tool to use when working with new potential food processor licensees. Handbooks were also provided to staff in the Organic program, Nursery Inspection Program and the Fruit & Vegetable Program who all attend numerous fall conferences that are attended by small farmers and value added farm business personnel.
- WSDA Staff who participated in fact sheet and video development, reviews and workshops where the Handbook information was provided. Cross agency collaboration resulted when various program areas worked together to ensure clear information was written and shared additional outreach opportunities that in turn helped to expand the number of fact sheets during the year. Fact sheets such as *Selling and Donating to Food Banks* and *Food Product Recalls* are just two examples of additional fact sheets developed from this collaboration. In addition, *The Food Product Recall* fact sheet was provided to farmers and food business owners during three recall workshops offered by WSDA Spring of 2014.
- Specialty crop farms that participated in the videos and photography sessions were able to help expand the written fact sheet information with actual footage of video or photographs demonstrating specific areas of fact sheet topics.
- Latino growers benefit from the development of the new on-line Handbook resources as the on-line website now provides a number of videos in Spanish.
- Agriculture Extension professionals attended many farm conferences and outreach events such as the farmer education classes and as a result they are better prepared to answer questions. These agricultural educators utilize the fact sheets and now the newly revised handbook throughout their work reaching additional stakeholders. Washington State University (WSU) Extension members attending the November 2014 Tilth Conference and the Northwest Food Safety and Sanitation Conference expressed excitement and appreciation of the new handbook and plan to use the hard copy and on-line versions in their work during 2015.

WSDA provided fact sheet outreach to over 486 farmers directly and an additional 400-500 were reached by our partners using the fact sheets before the final Handbook was published. Over 2,000 pre-published requests for printed Handbooks were received by WSDA prior to the hard copy print. On-line downloads of the new website will be tracked after this final report is submitted.

Eight new specialty crop fact sheets were to be created during this project but 15 were actually created bringing the total for the revised Handbook to 41 fact sheets.

LESSONS LEARNED

This project resulted in numerous WSDA agency staff participating together in the development of the fact sheet contents, video segment development and photograph work show casing information outlined in many of the fact sheets. Many WSDA program areas have had limited interaction across agency lines and this project created opportunities to cross divisional and program boundaries. In addition, many WSDA staff was able to interact directly with farmers and small businesses through the outreach events and while filming of videos and/or conducting the photography work. These one-on-one interactions continued to help identify areas of need for fact sheet clarifications and helped to encourage industry and staff to network together.

The website development took a shift toward the end of the project when WSDA determined the Handbook should reside on the agency's website and host the videos internally rather than through an outside hosted site as originally outlined in the project proposal. WSDA has been working on website improvements and this project provided the platform for our Communications Director and Website Developer to work with the SCBG Project Manager on creating the website pages for the Handbook materials and to upload the photos and videos associated with that various content sections. This work will enable WSDA to update the web materials more timely and will help to link other WSDA agency information to farm and other small businesses. The move to WSDA's website does prevent the Handbook from being downloaded to mobile systems at this time but we are looking for the agency to continue its improvements with our IT capability.

The unanticipated move of the on-line Handbook to WSDA's website has helped to identify additional improvements needed with WSDA's website. While these improvements will require work done after the project period, the benefit of WSDA's website improvement will help to streamline information between the Handbook and WSDA program specific information. This move also allowed for the development of a video on organic certification requirements that was not originally planned.

WSDA was not able to measure the farm sale impacts for the 2013-2014 year since the publication was not released in final form until October 2014 and the Washington State Farmer's Market Association had not yet completed their survey. However, WSDA distributed over 2, 300 Handbooks by mid November 2014 and is working with the WSDA Communications Office to track on-line website visits and downloads. In June 2014 WSDA documented over 6,500 downloads of the 2010 version of the Handbook alone. Promotion of the new URL: www.agr.wa.gov/farmfoodbiz at fall and winter outreach events is expected to double that number by April 2015. Seminar feedback from the November 1, 2015 Farm-a-Palouse-A –the 4th Annual Inland Northwest Small Farms Conference expressed that the new website information is one of the most useful tools provided to the attendees in addition to the new Handbook.

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ADDITIONAL INFORMATION

WSDA created a new URL for the Handbook that is easily identifiable and is used to help market the Handbook. The URL is: www.agr.wa.gov/farmfoodbiz

PROJECT #19

Project Title: Advancing food safety GAPs among Washington Specialty Crops Growers

Partner Organization: Washington State University (WSU)

PROJECT SUMMARY

Food safety risks present a significant financial threat to specialty crop producers, and on-farm production practices are critical for pathogen risk reduction. The initial project purpose was to increase knowledge and implementation of on-farm food safety practices and food safety documentation through interactive workshops with growers. The need for the project was driven by increasing buyer requirements for growers to document food safety practices and receive certification through various food safety and quality auditing programs (USDA GAPs/GHPs, SQF, Global GAPs, etc.). Moreover, the Food Safety Modernization Act (FSMA) had been passed in 2011, the year this project was funded. This legislation would also impact the need for growers to comply with impending food safety rules by the Food and Drug Administration. The release of the FDA Proposed Standards for the Growing, Harvesting, Packing and Holding of Produce for Human Foods Consumption (referred to as the proposed produce rule) in January of 2013 affected the approach of the remainder of the project.

Education for specialty crop growers was *timely* because farmers have an immediate need to strengthen food safety practices. The importance of the project was emphasized through increasing buyer requirements for grower food safety programs. Specialty crop growers implementing food safety practices and programs would experience enhanced economic benefits through implementation and documentation of food safety practices in order to qualify for third-party certification, meet buyer requirements and have broader marketing options. Moreover, specialty crop producers with documented food safety programs reduced financial risk. A long-term outcome of the project was reducing the risk of Washington specialty crops being linked to food recalls and foodborne outbreaks.

PROJECT APPROACH

Project Activity	Amended	Completed
Assemble GAPs Team		Oct 2011
GAPs Team Meetings	WSDA Education and Outreach staff met regularly with WSDA GAP/GHP audit staff to plan events, strategize the project, and write and edit the manual. WSDA GAP/GHP IT representative worked closely with Education and Outreach staff to develop web-based resources, such as the initial contact listing and email links, the online Q&A, and the web-based audit request wizard, and to update web information.	Throughout project
Conduct On-Farm Auditor Training	Four 2-day trainings were provided to auditors, with a classroom component and attendance at on-farm pre-audit grower assessment events. Auditors attended 3	August 2014

	<p>additional pre-audit grower assessment events (without a classroom component) to provide them with insight and experience on diverse farms. (Four 2-day or eight 1-day trainings were originally scheduled.)</p> <p>Auditors also received Bridging the GAPs training at their annual refresher course meetings.</p>	
Conduct On-Farm Grower Pre-Audit Assessments	<p>7 pre-audit grower assessments were completed in different regions of the state. (Four were originally planned)</p> <p>WSDA also conducted 2 roundtable events for growers and auditors in regions of the state where host farms could not be found for on-farm events.</p>	June 2014
Contribute Feedback and Comments to National Level Food Safety Discussions	<p>Ongoing. WSDA used this project to share information and encourage growers to provide comments during FSMA comment period, and to gather questions and feedback from growers to inform WSDA's comments. WSDA staff attending national meetings and local listening sessions shared questions and concerns from growers throughout the project.</p>	Sept 2014
Develop GAP/GHP Training manual for small to mid-size specialty crop growers and processors	<p>Spanish and English versions, in hard copy binders with flash drive templates and documents, and online version with interactive Table of Contents and live links</p>	Sept 2014
Design and conduct surveys for sales impact and customer service	<p>Adapted WSDA farm survey to include GAP questions (conducted Spring 2014), and surveyed project participants at and after events (throughout project)</p>	June 2014
Develop online wizard for GAP/GHP	<p>Part 1: Info webpage and Q&A for farmers on GAP/GHP standards and audit</p>	June 2012

	process Part 2: Online audit request form	Sept 2014
Post training manual online		Sep 2014

Project Activity Descriptions:

- Pre-audit grower assessments for small, mid-sized, and diversified specialty crop farms provided opportunities for host farms to receive auditor feedback on their food safety practices, and to serve as leaders and examples in their region, as they invited farm peers and auditors to their farm to learn more about on-farm food safety. At each event, growers and auditors walked the farm, discussed key issues with WSDA educators, and learned ways that farms of that type, scale and region could meet the GAP standards in cost-effective ways. WSDA educators and auditors were able to share real-life examples of worker sanitation facilities, hand wash stations, harvest and field packing practices, compost systems, and produce washing and storage areas, allowing them to discuss with growers the food safety implications of the various models, along with ways growers can cost-effectively adapt practices to improve food safety on their farms. These events also served as a forum for WSDA to share information and updates on FSMA implementation, Washington State Food Code provisions that affect small farms, and to discuss market demand and reasons for food safety planning and certification.

Two of the pre-audit grower events were provided with Spanish-language interpreters, and with particular attention to demonstration as a teaching method, in order to better reach Latino growers. At both events, a bilingual GAP/GHP auditor was in attendance to answer questions and clarify GAP standards. The Yakima event was presented with WSU Small Farms Team partners who provided assistance with planning, farmer recruitment, materials translation (including a Spanish language food safety glossary), and on-site interpretation. The Viva Farms event in Mt. Vernon was a partnership with Viva Farms, and reached both a Spanish and English-speaking audience. This event was presented in conjunction with an RMA-funded Wholesale Success training which was held on the following day.

- 7 pre-audit grower assessments were completed in regions spanning the state
- 189 farmers and other constituents participated
- 40 auditors participated



WSDA GAP/GHP auditors discussing and learning about outdoor packing areas at Skagit Flats Farm.



WSDA Educator and GAP/GHP auditor teaching field-side at Pheasant Fields Farm.

Farms responded well and joined in with their questions, concerns and plans for food safety planning and implementation. Host farmer Nikki Johanson sent the following thank you by email to the project coordinator:

I want you to know how much I and a lot of others appreciated you coming to Kitsap. Look out, it's just the beginning. We will call on you again for help as we write those policies, etc. The training here has created all kinds of dialog and a ripple effect. And there's a new conversation about it every week. It is a

pleasure for me to write about and talk about the very positive things your team is doing for small farmers in WA (and, I'm good at talking). You know I was a bit apprehensive having you come HERE, but it's the best thing I've ever done for Kitsap farms and farmers.

- Producers' Roundtables gathered growers, auditors, educators and buyers to discuss market and regulatory requirements for food safety, with a focus on better understanding the constraints and opportunities associated with each of the different participants' businesses. The Spokane Roundtable also provided three different types of buyers the opportunity to share why food safety certifications are useful to them, and what they expect from growers in relation to on-farm food safety.
 - Producers' Roundtable on GAPs in Moses Lake October 28, 2013
 - Producers' Roundtable on GAPs in Spokane May 7, 2014
 - 44 farmers, processors, buyers, and advocates attended
 - 2 auditors participated

The roundtable model was adopted during Year 2 of the three year project because there had been a shortage of farms willing to host on-farm events in some parts of the state. As a result WSDA held roundtable meetings in place of on-farm events in areas not served by on-farm events. As growers became more familiar with the project, WSDA found that farmers preferred on-farm events and more growers stepped forward to host. Therefore, only two roundtable events were held, and others were able to be provided as growers appear to prefer—on-farms.

The following quote came from one Producers' Roundtable participant, whose farm's market-participation was subsequently featured in a local news story:

Hello,

Jackson Farm was featured on KREM today. Here is a link to the story.

<http://www.krem.com/longform/news/local/good-news/2014/10/10/jackson-farms-offer-fresh-school-lunches/17058517/>

This all came together starting with the meeting (Roundtable) in Spokane in March, so thank you for all of your efforts at the state level.

Dan

- GAP/GHP Auditor professional development and partnership
 - In total WSDA GAP auditors participated in one or more components of this project 109 times (some auditors came to multiple events), whether that was by attending trainings, joining a farm-walk, or speaking at an event. Some auditors participated in several different kinds of activities. Auditor trainings provided auditors with opportunities to see practices on small, diversified farms in different regions of the state, including rustic outdoor packing areas, common storage and transport practices, and basic documentation systems, and discuss simple, cost-effective ways these growers can meet the GAP/GHP standards within their constraints of cost, staffing, and space. Auditors were also able to see and discuss a variety of place-specific food safety issues such as flooding and over-wintering birds. Auditor trainings were designed as two-session events, most with a first session on Day 1 with a WSDA educator leading a presentation and discussion about the specific agriculture, climate, markets and food safety challenges for the specific geographic region, and Day 2 tied to an on-farm grower/auditor education event. This allowed WSDA to provide on-farm education to more growers and auditors in more areas of the state (rather than having some host auditors only and others host only growers). This evolution occurred because the farm host of the first auditor training asked if he could invite other area farmers, and WSDA found that the cross-pollination and discussion increased learning and trust-building for all participants.
 - WSDA presented on Bridging the GAPs at annual WSDA GAP/GHP auditor refresher courses each year of the project.
 - Year One: WSDA Education and Outreach staff introduced the project, discussed grower types, regional food safety issues (like flood plains and wintering geese), and language that works when talking about food safety with small-scale diversified growers. The language section provided

excellent conversation about how different types of farmers think and talk about “commodities” vs. “crops” or “food,” “farms” vs. “operations,” etc., and worked to encourage auditors to use plain language when out in the field, as a way of translating the audit language to farmer practice and style.

- Year Two: WSDA Education and Outreach staff discussed the FSMA comment process and upcoming implementation, including potential impacts on farms being served by this project. The group also provided an update on the Bridging the GAPs project and discussed Bridging the GAPs resources for them to share with growers: the project website, online Q&A, Spanish language audit checklist. WSDA staff discussed other food safety topics that affect growers, including the 2009 FDA food code fact sheet and a state-level cut leafy greens fact sheet, so that auditors would be able to knowledgeably discuss related topics that might come up in farm audits.
- Year Three: WSDA Education and Outreach staff shared updates on Bridging the GAPs project end stages and introduced the Bridging the GAPs Farm Guide, encouraging them to use the guide as a resource and direct farms with pre-audit inquiries to the guide. The group also discussed Harmonized GAP standards and new developments in water testing expectations.
- Four auditors were featured in educational/technical assistance videos, available in English and Spanish
- Three auditors contributed significantly to the development of the Bridging the GAPs Farm Guide, as well as the online Q & A

Summary of Auditor Trainings, Grower Pre-audit Assessments, and Producers’ Roundtables

May-14	Event/Workshop	Auditors	Farmers & others
Imperial's Garden	Grower pre-audit assessment	9	9
Yakima F & V Office	Auditor Training	11	
Williams Hudson Bay Farm	Grower pre-audit assessment	6	6
Pasco F & V Office	Auditor Training	10	
Spokane region	Producers Roundtable on Food Safety	1	40
Mar-14			
Cultivating Success <i>Snohomish/Pierce County</i>	On-farm food safety workshop	1	24
Dec-13			
Viva Farms	Grower pre-audit assessment	2	40
Oct-13			
Alvarez Farms	Grower pre-audit assessment	2	8
Oct-13			
Moses Lake	Producers' Roundtable on Food Safety	1	3
May-13			
Local Roots	Grower Pre-audit assessment	8	19
	Auditor Training	8	
Apr-13			

Pheasant Fields	Grower pre-audit assessment	4	30
Aug-13			
GAP Auditor Refresher	Project introduction; Q & A	15	
Aug-12			
GAP Auditor Refresher	Project update, Q & A	15	
Mar-12			
Seattle	Auditor training	7	
Skagit Flats	Grower pre-audit assessment	7	5
		Auditors	Farmers & others
	Total	109	188

Bridging the GAPs Farm Guide Development

As the culmination of the project, based on key questions and experience gained throughout the project, WSDA developed the Bridging the GAPs Farm Guide, a friendly, attractive, clear and simple manual to help farms meet GAP/GHP standards and improve food safety practices on their farms. WSDA hired a photographer to join them on host farms to obtain photographs of real-life on-farm practices and systems that target readers would relate to. The guide highlights on-farm examples from Washington’s small farms, shares auditor tips for making the process go more smoothly, highlights frequently-asked farmer questions, and shares a variety of options for meeting GAP/GHP standards. It is presented in the order of the USDA GAP/GHP Audit Checklist, to help growers build systems and documentation that will be simple for auditors to review during an audit. The guide is available in English and Spanish, in binder form, with sample documents and templates from a range of sources, and each guide is provided with a flash drive of Word files of the templates so that farmers can easily adapt them for their own use. These guides and templates are all available for download on WSDA’s website at: <http://agr.wa.gov/Inspection/GAPGHP/Guide.aspx>. WSDA printed 500 copies of the English guides and 100 copies of the Spanish guides. Guides are being distributed at conferences and events in Fall of 2014 and into the future, until all have been distributed.



Additional Resources to Support On-Farm Food Safety Planning:

- An on-line Q & A captured the complex kind of questions that small, diversified farms have when trying to adapt the GAP standards to these kinds of operations;

- Online wizard to assist growers with planning for and scheduling an audit;
- Dissemination of two short instructional videos, both in English and Spanish.

Contributions to regional and national discussions regarding market and regulatory requirements for food safety, both current and future:

In addition to planned events to meet the specific grant deliverables, WSDA staff gave presentations at the following regional conferences to promote the project and disseminate GAP information:

- Cultivating Success, March 4, 2014
- Whatcom Sustainable Ag Conference March 7, 2014
- Camino al Exito, or Road to Success, February 4, 2014
- Bainbridge Graduate Institute, December 4, 2013
- Washington State Farm Bureau Annual Meeting, October 18-20, 2013
- Jefferson/Clallam County Farm to Table presentation, April 16, 2013
- WSU Small Farms Team Retreat short presentation, March 21-22, 2013
- Organicology Conference presentation, Portland, OR, February 7, 2013
- Bainbridge Graduate Institute webinar presentation to students, November 28, 2012
- Washington State Farm Bureau Annual Meeting presentation, Yakima, WA, November 14, 2012
- Tilth Conference presentation, Pt. Townsend, WA, November 11, 2012

WSDA collaborated with USDA staff on delivery of training and education, especially regarding bi-lingual educational resource development and gaining clarity on GAP standards in practice. This collaboration also provided feedback to USDA about the needs and concerns of small and diversified growers as they attempt to meet GAP/GHP standards.

WSDA staff shared information about FSMA implementation at all stages of the project, including sharing comment period information and copies of proposed rules, and encouraged growers to comment. Additionally, WSDA educators were able to take comments and concerns expressed during these events by small growers, and share them in national meetings and local FDA listening sessions.

GOALS AND OUTCOMES ACHIEVED

The project team conducted four full-day, introductory “Session I” workshops, five follow-up “Session II” workshops and one “Session III” follow-up workshop. The target for workshop participation was achieved. During the project, 214 participants (target 210) attended Good Agricultural Practices workshops. At each workshop, evaluations were distributed to examine measureable outcomes and project impacts.

- The majority of participants (74-84%) strongly agreed or agreed that the Session I workshop would be useful in conducting farming practices that incorporate GAPs either informally or formally (Table 5).
- Furthermore, 63-90% strongly agreed or agreed that Session I information would be useful in communicating about GAPs in their operations or when working with other groups or individuals related GAPs, food safety and direct marketing issues (Table 5).
- Finally, 90-93.3% of participants strongly agreed or agreed that the goals of the Session I workshop were achieved (Table 6) and 80-100% of Session II and Session III participants felt the goals of the workshops were achieved (Table 10).

The project goal was to increase the number of specialty crop growers with a completed operational risk assessment and increase implementation of accurate recordkeeping systems. These are long-term goals for many growers; there are a variety of topic areas within a GAPs food safety system that must be addressed. The project team worked with growers to prioritize areas for implementation or improvement based on their completed risk assessment. The project team worked with growers to set annual goals to make progress towards GAPs implementation and accurate recordkeeping.

Progress for on-farm risk assessment among specialty crop growers (Tables 4 and 8 at the end of this report).

The data collected through workshop evaluations indicated that 84 specialty crop growers participating in the project either completed a risk assessment (42) and 42 were making progress on their risk assessment. For session II participants, 33-39% indicated that the status of their risk assessment had changed after attending the GAPs Session I workshop. For Session III participants, 50% indicated their risk assessment status changed between GAPs workshops.

Progress for on-farm GAPs recordkeeping among specialty crop growers (Tables 4 and 8 at the end of this report).

The data collected through the workshop evaluations indicated that 85 specialty crop growers participating in the project were currently addressing or implanting recordkeeping for GAPs; 48 indicated recordkeeping was currently addressed and 37 were implementing recordkeeping practices. For Session II participants, 37-48% indicated that recordkeeping status had changed after attending the GAPs Session I workshop. For Session III participants, two-thirds (67%) indicated their recordkeeping status changed between GAPs workshops.

Potential for additional long-term outcomes and impacts from the GAPs project (Table 11 and 12 at the end of this report):

Several growers indicated interest in risk assessment, recordkeeping and specific food safety practices. Development of food safety programs in any operation is a cyclical process. Due to the dynamic crop and food production environment, food safety systems must be assessed and adjusted regularly. Therefore, the project impacts are likely to continue for many years after completion of the workshop programs associated with this project. Follow-up evaluations with growers are planned to continue to assess project outcomes and impacts. The project team determined that follow-up evaluations should be performed after completion of the project due to significant changes proposed in the original and supplemental versions of the proposed produce rules. The final rule will have a significant effect on GAPs practices, so establishing additional baseline data closer to the release of the final rule would be advantageous. Furthermore, growers may delay adopting some GAPs practices until final regulatory expectations are released, especially related to manure management and irrigation water management and testing.

The project goal was to increase the number of specialty crop growers with a completed operational risk assessment and increase implementation of accurate recordkeeping systems by offering a series of food safety workshops focusing on increasing knowledge and awareness and implementation of food safety practices in specialty crop operations. Additionally, it was anticipated that growers would adopt additional GAPs practices as a result of participating in the workshops.

At Session I workshops, participants indicated their intent perform several items as a result of attending the workshop (Table 3). In both years, 73-79% of participants indicated they would share information gained with others. In 2012, the second and third most frequent categories were improving food safety GAPs (59%) and gathering more information (56%) followed by the goals of the workshop implementing food safety GAPs and risk assessment (47%) and recordkeeping (47.8%). In 2013, gathering more information was also a frequent response (79%) followed by the goals of the workshop implementing food safety GAPs and risk assessment (52-63%) and recordkeeping (63%). Participant responses indicated that the curriculum content aligned to increase knowledge and awareness among participants to consider completion of a GAPs food safety assessment and implementation of recordkeeping.

Evaluation data from Sessions II and III correlated with responses from Session I. The largest response category for progression on food safety practices related to GAPs between workshops was the implementation of employee training (sharing information with others), followed by risk assessment and recordkeeping (project goals). Among specific food safety practices that were implemented between workshops, highest response categories were: wildlife and animal assessment, adding or changing hygiene signs, chemical storage assessment and monitoring, harvest, storage and transportation sanitation, pest control and worker hygiene facilities monitoring (Tables 11 and 12). Standard logic model concepts indicate that groups utilize increased knowledge and awareness in order to implement behavior change and subsequent long-term outcomes. Therefore, the Session I workshop focused on increasing

knowledge and awareness while the Session II and III workshops focused on advancing risk assessment completion and implementation of recordkeeping as well as other food safety GAPs practices.

Awareness and Knowledge among Participants based on evaluation data:

Participants documented increased knowledge and awareness in several, specific categories from Session I workshop topics. In 2012, the top five categories that participants increased knowledge and awareness by one or more levels were the same: manure management, irrigation water management and testing, as well as overall GAPs. Marked knowledge and awareness (an increase of two or more levels) were also noted for the 10-14% of participants in the areas of: third-party certification, food safety, regulatory aspects, risk management and harvest/post-harvest sanitation. It is worthy to note that at **Session I in 2013, over 50% of participants documented an increase in knowledge and awareness in 13 of 15 categories measured.** This may indicate that proposed regulatory approaches in some specific areas differed or were more specific than previously recommended and/or third-party GAPs expectations. The top five categories that participants documented marked increases (two or more levels) in the following areas: manure management, irrigation water management, food safety regulatory aspects, preventive controls, sanitation programs, food safety and allergen controls.

Evaluations documented that participants gained awareness of food safety issues that would be communicated to others. From Session I, an increase from 2012 to 2013 was reported by participants regarding transferring information from the workshop to other people. In 2012, half of the participants indicated they would transfer information gained at the Session I workshop to 1-9 other individuals. In 2013, 26% indicated they would transfer information to 10-24 individuals and 21% indicated they would transfer information to 25-49 individuals and 1-9 individuals respectively (Figure 4). This increase in information transfer may have been related to the release of the proposed produce rule in January of 2013 and the open comment period on this proposed rule during the workshops. For Session II in both 2011 and 2013, the most frequent response was the transfer of information to 1-9 people. For Session III, participants most frequently indicated that information would be transferred to 10-24 people.

Economic benefits frequently reported by participants included keeping existing customers (56-66%) and gaining new customers (41-50%) (Table 9). Furthermore, 3 participants from Session II and III workshops indicated that they received third-party GAPs certification after attending the Session I workshop and 28 intended to become third-party GAPs certified. Several (27) Session II and III participants had already received third-party certification; Session I evaluation data indicated that almost half of participants intended to improve food safety practices, which would indicate that growers continue to strengthen their food safety practices even though certification is achieved.

Baseline Data and Achievement of Target Goals for Completion of Risk Assessment and Implementation of Recordkeeping:

Project targets were exceeded when compared to baseline data. For specialty crop producers evaluated at Sessions II and III (83), **30 participants reported a change in status for risk assessment activities and 35 participants reported a change in status for GAPs recordkeeping** (target of 27 participants based on calculations from previous baseline data). Baseline data from previous GAPs projects indicated that one-third of evaluated participants were in-progress or completed risk assessments and GAPs recordkeeping practices (see original project proposal benchmark). Applying this baseline to data collected from participants at Session I and II indicated that 27 participants (one-third of those evaluated) should report a change in status for risk assessment and recordkeeping activities.

BENEFICIARIES

The project outcomes reached several specialty crops of economic importance in Washington. Project workshops reached a wide range of specialty crop producers, based on evaluation of participant demographics. Participants from small and large operations attended the workshops and represented both beginning and experienced growers. Farm owners, managers and employees represented 65-83% of workshop attendees. Others involved with specialty crop production that attended the workshop included field consultants, managers and employees of farmer's markets, packing facilities and distribution centers.

A broad range of specialty crops were marketed by workshop participants. In 2012 for Session I, 33% of participants marketed tree fruit, 29% marketed berries, 22% root crops, 19% leafy greens, 13% herbs and tree nuts (2.5%); for 2013, more participants marketed berries, leafy greens, herbs and tree nuts compared to 2012 (Figure 3).

Participant Demographics: For Session I in 2012 and 2013, 42-53% of participants were farm owners, managers or employees. Both beginning and experienced growers attended the workshops. In 2011 for session 1, individuals with less than 1 to 4 years represented 34% of attendees and the remainder was fairly evenly distributed between the remaining categories; in 2012, over 20% of participants reported having 1–4 years, 5-9 years and 10-19 years of agricultural experience.

For Session II, participants with less than 1-4, 20-29 and 30-39 years of experience represented the most frequent categories for agricultural experience in 2011 and for 2012, 1-4, 5-9 and 10-19 years were the most frequent (Figure 5). For session II, participants were fairly well distributed (Figure 5). Session III also represented a broad range of agricultural experience among participants (Figure 5).

Workshop participants represented growers with small and large farms. For Session I, in 2012, growers with less than 10 acres represented the largest category (25%), with 5-11% of participants representing the following categories (50-249, 500-2500 and more than 2500). In 2013, a higher percentage of growers with large acreage attended Session I, 57% responsible for 50 - >2500 acres (Figure 2). For session II, similar distributions were observed in both years. Session III was attended mostly by participants with 50-250 acres (Figure 6).

LESSONS LEARNED

The project team learned that it is important to listen to the needs of the stakeholders. The originally proposed workshop format and timing of the third workshop (a field day focused on audit preparation during the field season) did not align with grower needs. Additional Session III workshops in 2013 were not held due to the release of the proposed produce rule; this proposed rule represents significant changes for certain GAPs practices, and it was anticipated that many participants would wait until more clarity was gained regarding regulatory expectations. Previous experience with delivering GAPs workshops and evaluation data has indicated that workshop attendance peaks in response to outbreaks or when regulatory/third-party recommendations are adjusted or released. The project team has observed when uncertainty about expectations increases, workshop attendance and willingness to adjust farming practices declines until further recommendations or rules are released.

The team learned that there is a great deal of confusion among growers regarding differences between food safety “best practices”, regulatory requirements and third-party certification programs. The term “GAPs” is used loosely or has associations with all three of those areas which led to challenges in communication and education about GAPs. The team developed tools to describe and compare these areas that were used in Sessions II and III workshops.

In the final year of the project, a statistical analysis was performed to investigate relationships between participant demographics and aspects of GAPs implementation. Although the evaluation dataset had a respectable response rate (67% of participants completed evaluations), the Chi-square analysis for individual questions often indicated that insufficient responses were available in certain categories to support a legitimate statistical conclusion.

A significant conclusion from the project based on participant demographics is that food safety training is needed among a broad range of specialty crop producers. Participants included a variety of specialty crop producers (new and experienced) responsible for 1 to over 2500 acres (See Figures 1-3 and 5).

Several participants represented large specialty crop operations and several had already received third-party certification. This emphasizes the conclusion that food safety training is a progression rather than a “destination”. The project team emphasizes a “food safety journey” to participants.

CONTACT PERSON

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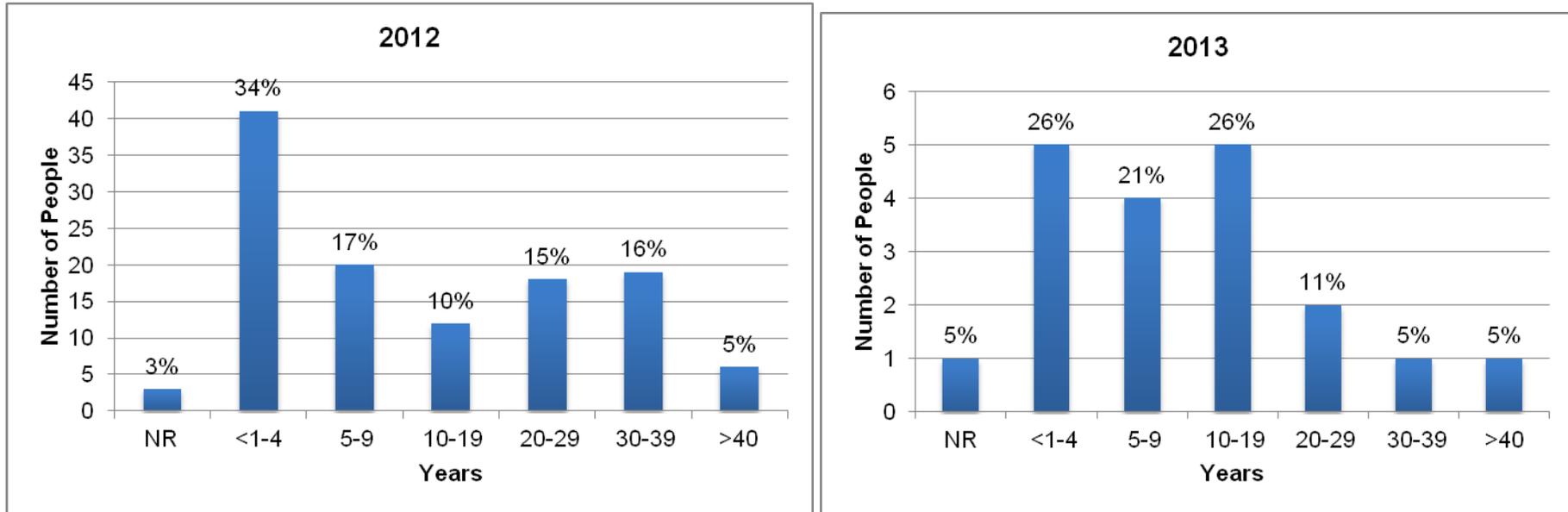
ADDITIONAL INFORMATION

In-kind match for this project was \$51,106.00. Indirect costs were waived by Washington State University, which were calculated at 49.5%.

Evaluation data is provided as a component of this report and will be used to generate appropriate publications. It is anticipated that follow-up evaluations and interviews will also be performed as the proposed produce rule is finalized to ascertain additional baseline data prior to response to regulatory expectations.

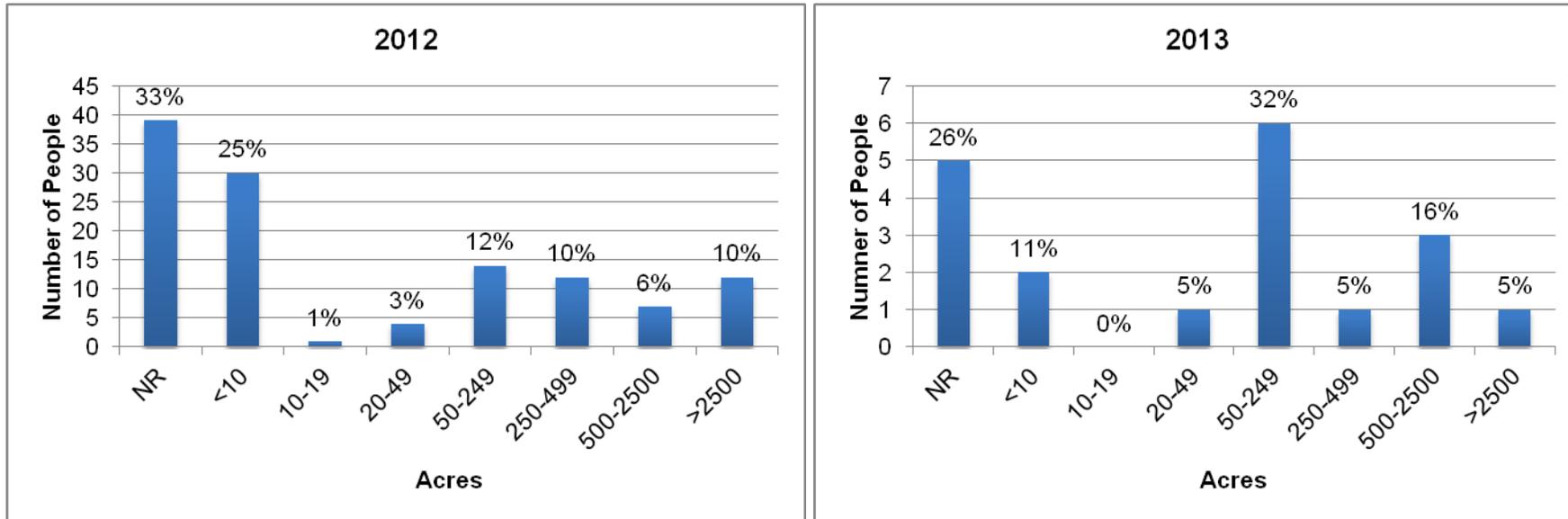
Session I – 2012 & 2013

Figure 1. Number of years of agricultural experience of participants in session I workshop 2012 (n=119) and 2013 (n=19).



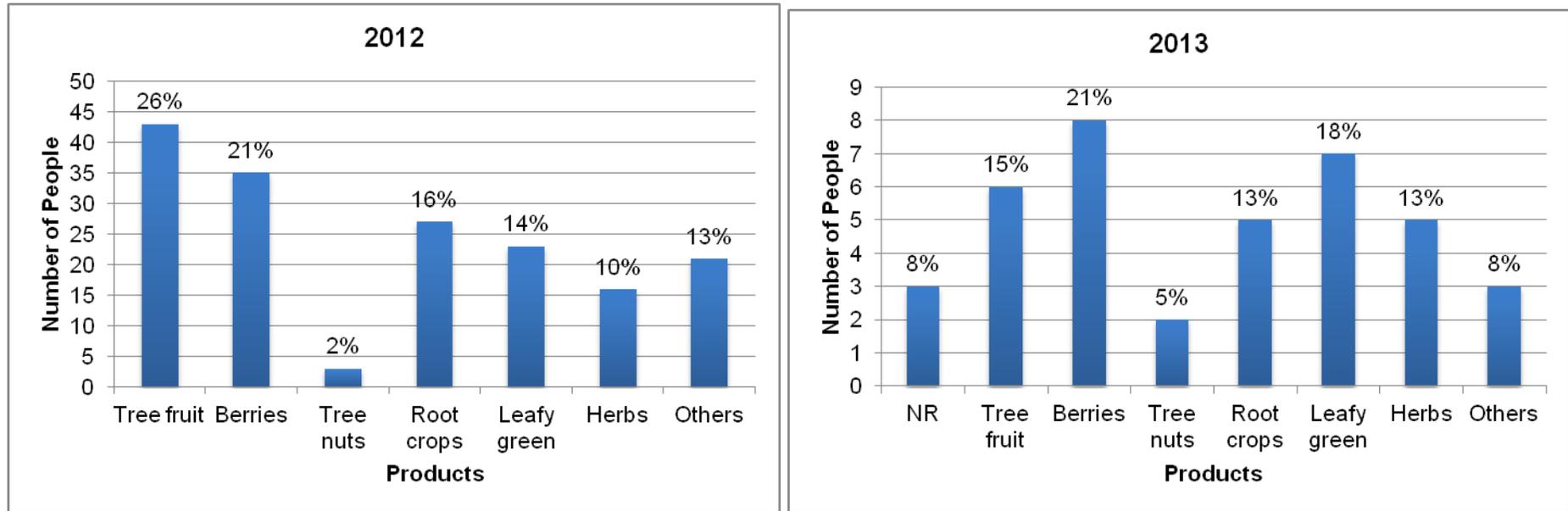
NR means no response.

Figure 2. Number of acres that participants are responsible for in session I workshop 2012 (n=119) and 2013 (n=19).



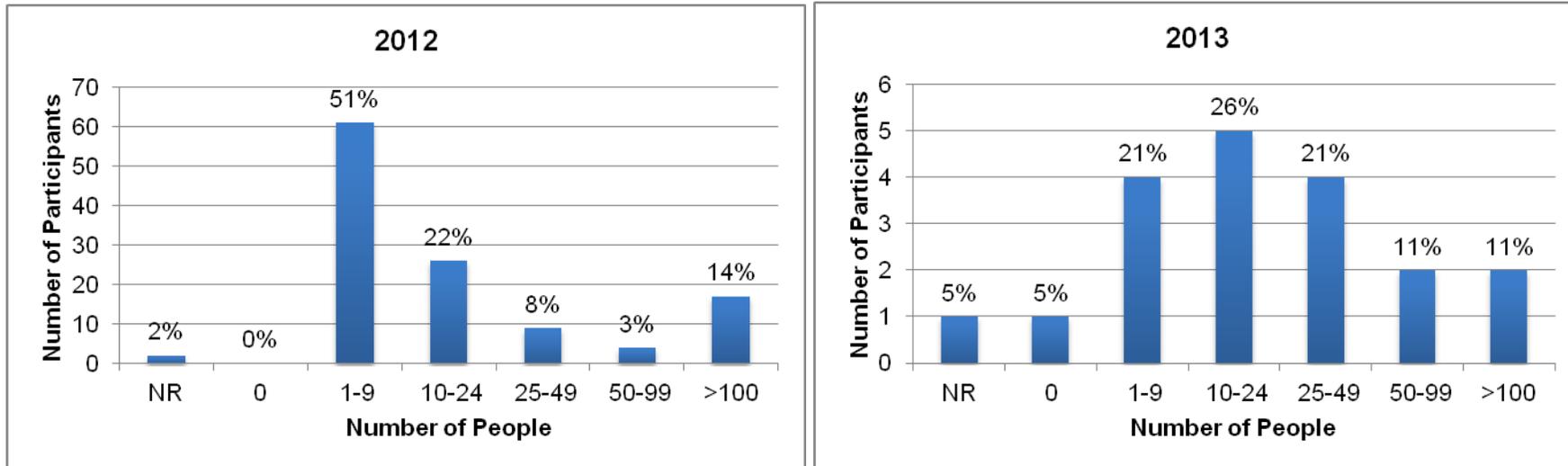
NR means no response.

Figure 3. Products grown and marketed by participants in session I workshop 2012 (n=168) and 2013 (n=39).



NR means no response.

Figure 4. Number of people to whom participants will likely transfer information from the session I workshop in 2012 (n=119) and 2013 (n=19).



NR means no response.

Figure 5. Number of years of agricultural experience of participants in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop. NR means no response.

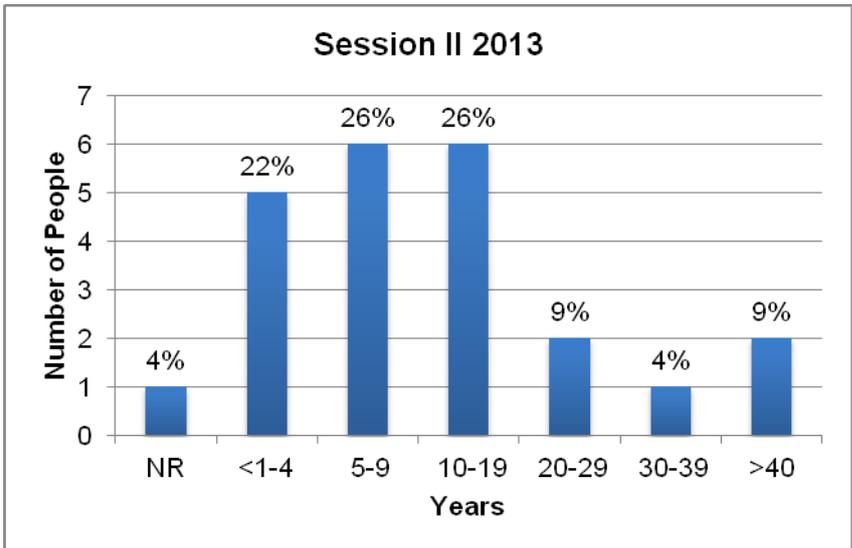
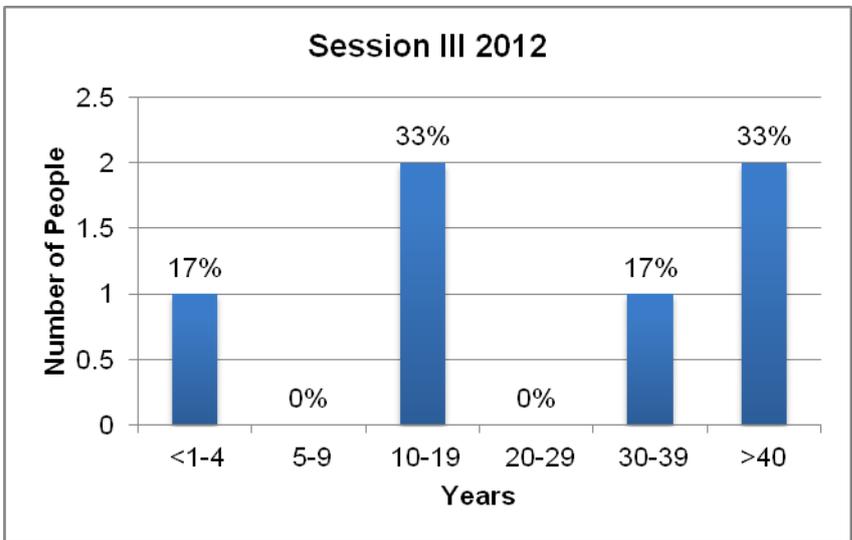
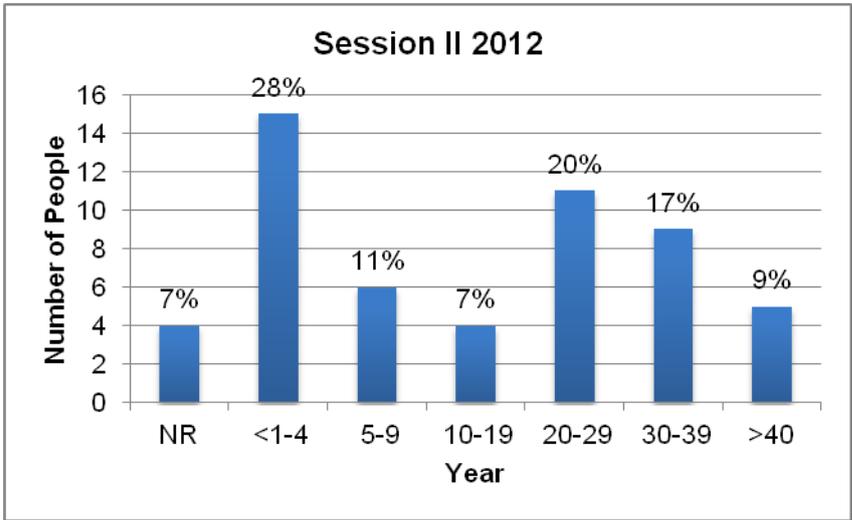


Figure 6. Number of acres that participants are responsible for in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop. NR means no response.

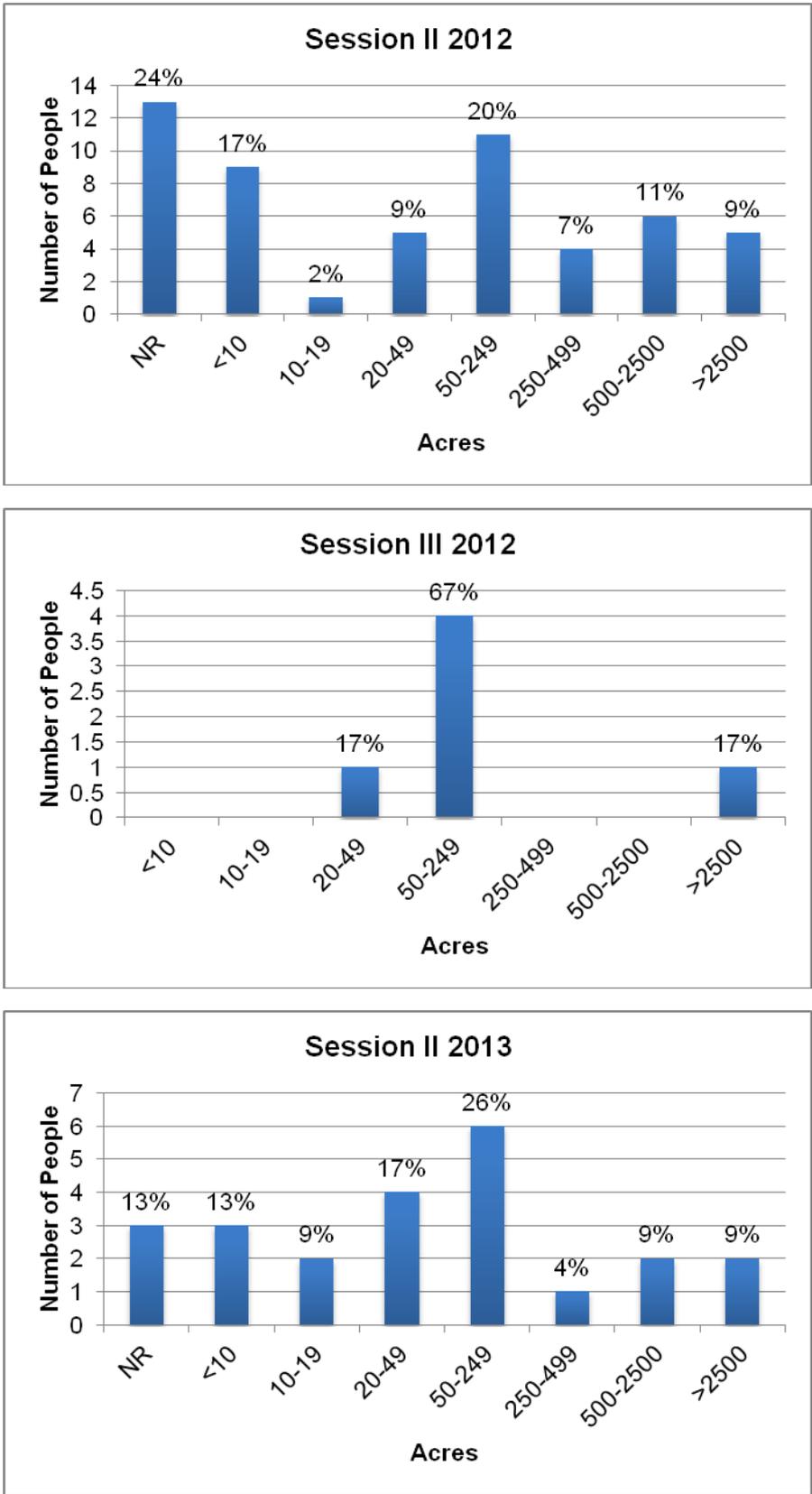
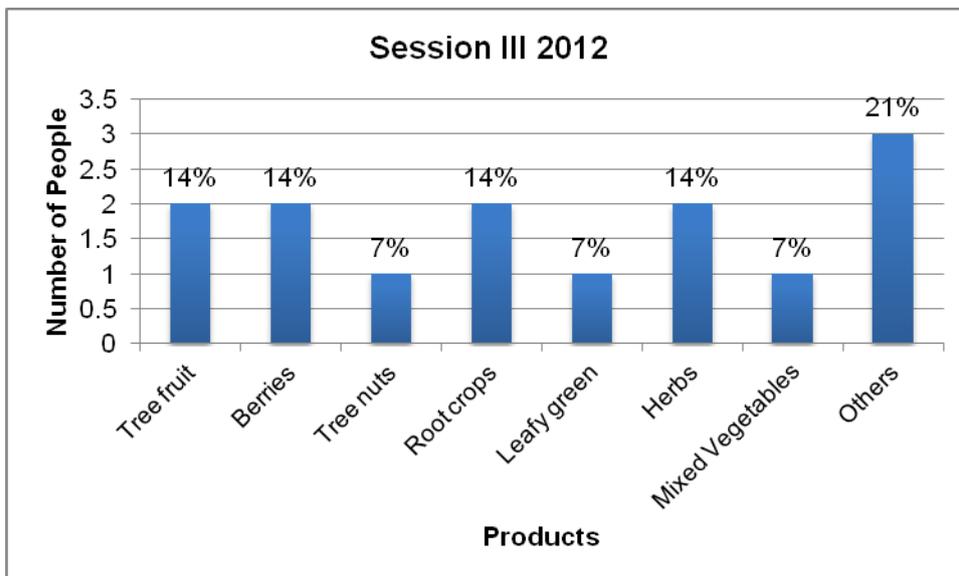
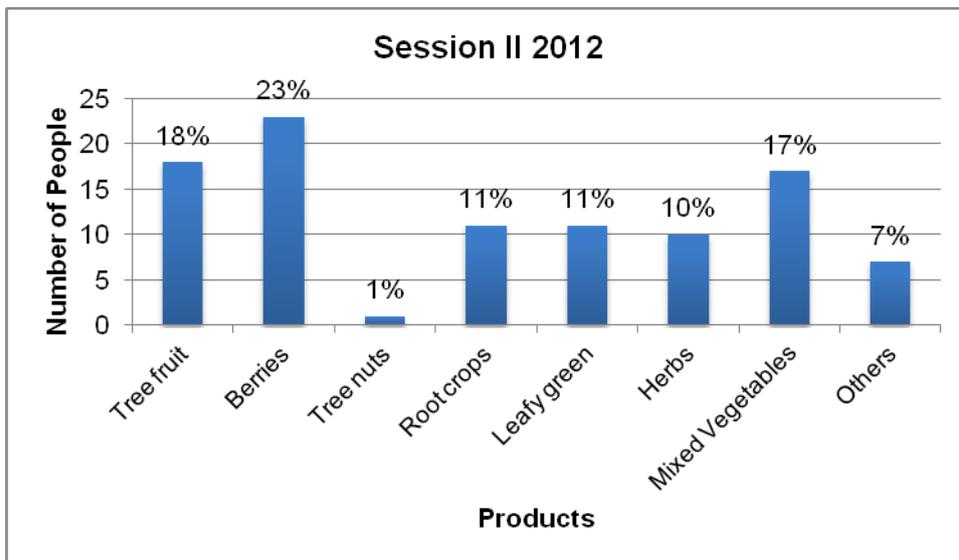


Figure 7. The products that participants grow and market in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.



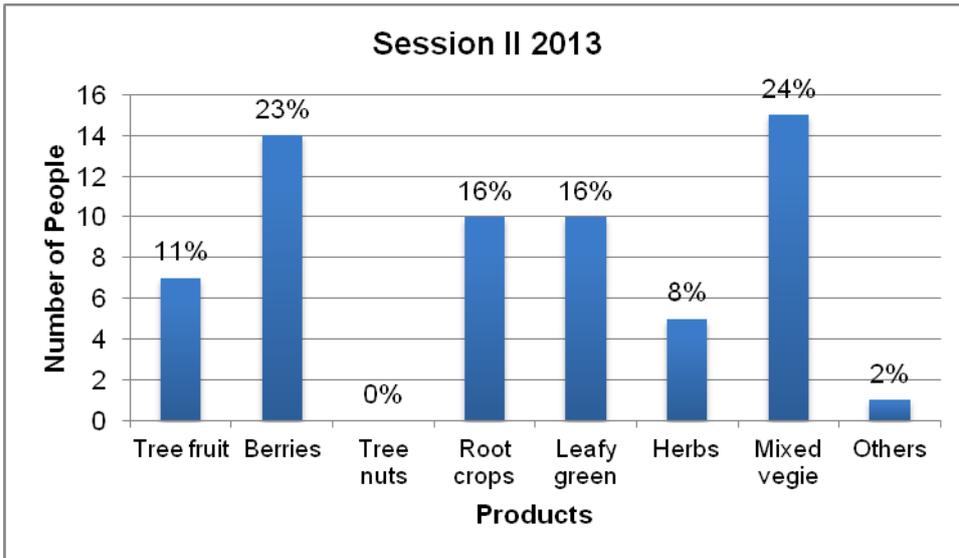


Figure 8. Number of people to whom participants will likely transfer information from the workshop of session II (n=54), III 2012 (n=6), and session II 2013 (n=23). NR means no response.

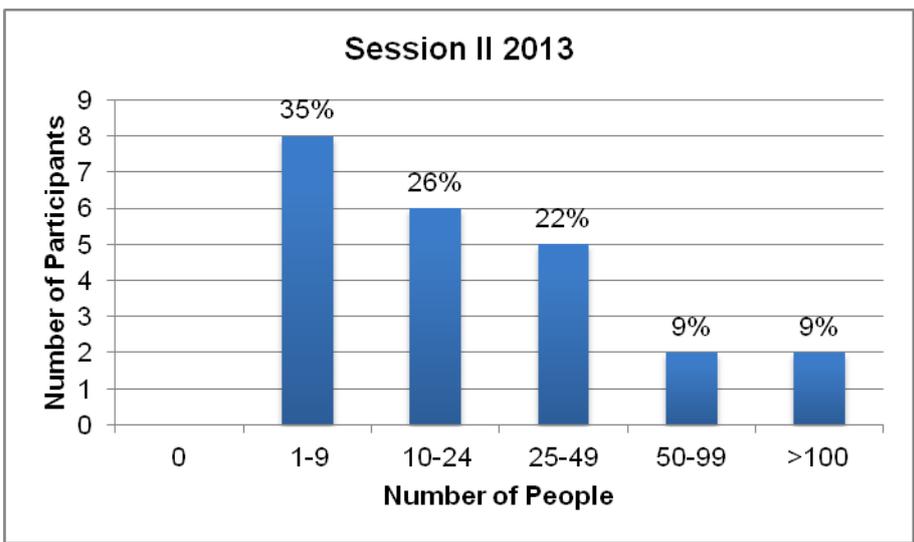
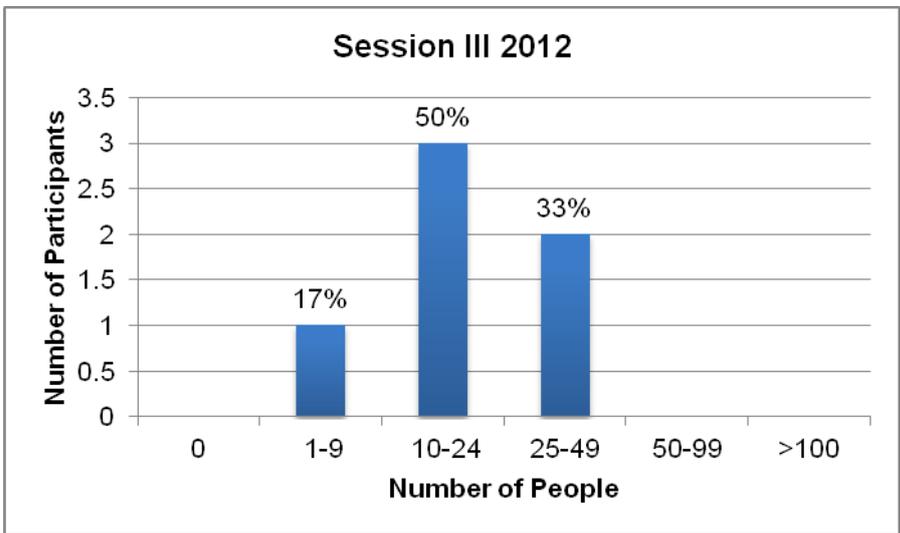
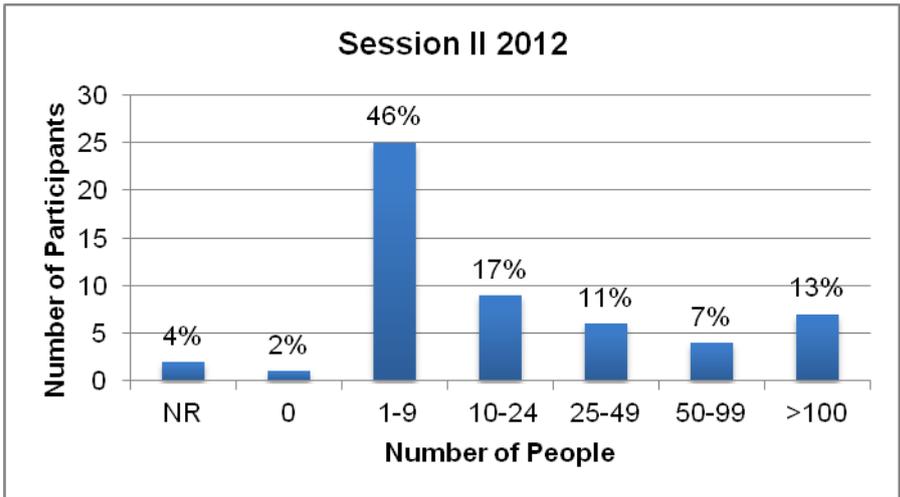


Table 1. Profession of participants in session I workshop 2012 (n=131)* and 2013 (n=19)*.

Profession	Percentage and Number of Responses	
	2012	2013
Farm owner	17.6% (23)	21.1% (4)
Farm employee	10.7% (14)	10.5% (2)
Farm foreman or manager	13.7% (18)	21.1% (4)
Manager (Farmer's market/ packer/ food distributor)	8.4% (11)	0.0%
Employee (Farmer's market/ packer/ food distributor)	2.3% (3)	15.8% (3)
Field consultant	9.2% (12)	10.5% (2)
Research/ Extension	6.9% (9)	0.0%
Other	16.0% (21)	21.1% (4)
Regulatory/gov't	3.1% (4)	0.0%
Student	12.2% (16)	0.0%

*Total responses used for percentage calculation.

Table 2. Level of awareness or knowledge of topics prior to and after session I workshop in 2012 (n=119) and 2013 (n=19).

Category	2012		2013	
	Percentage reporting increased knowledge (%) ^a	Percentage reporting marked increase in knowledge (%) ^b	Percentage reporting increased knowledge (%) ^a	Percentage reporting marked increase in knowledge (%) ^b
GAPs	61.4	16.0	63.2	15.8
Risk Management	55.1	12.7	57.9	10.5
Food Safety	51.3	6.7	63.2	21.1
Food Safety Regulatory Aspects	49.6	13.5	73.7	26.3
Manure Management	74.0	29.4	68.4	31.6
Irrigation Water Management	68.9	21.0	78.9	26.3
Irrigation Water Testing	72.3	24.4	68.4	15.8
Worker Health & Hygiene	33.6	3.4	68.4	10.5
Harvest and Post-Harvest Sanitation	53.0	10.1	63.2	15.8
Third-Party Certification	43.7	14.3	31.6	15.8
Traceability	45.3	8.4	42.1	10.5
Preventive Controls	-	-	66.7	22.2
Allergen Controls	-	-	50	16.7
Recall Management	-	-	50	11.1
Sanitation Programs	-	-	50	22.2

*Categories were not included. ^a Column indicates percentage of participants reporting a one-level increase ^b Column indicates percentage of participants reporting two or more level increase

Table 3. Indication of one or more things that participants intend to do at work as a result of attending session I workshop in 2012 (n=119) and 2013 (n=19).

Category	Number of People	
	2012	2013
Implement food safety/ GAPs	56	10
Improve food safety/GAPs	70	9
Share information provided	87	15
Risk Assessment	56	12
Risk Reduction	52	9
Risk Monitoring	46	8
Test Water Quality	45	14
Recordkeeping	57	12
Gather more information	67	15

Table 4. Participants' status of the farming systems or interests from session I workshop in 2012 (n=119) and 2013 (n=19).

	Number of Response (n)	Performance of a GAPs Assessment	Performing aspects of GAPs	Recordkeeping for GAPs	GAPs Third-Party Certification
2012	Completed	23	-	-	23
	Currently addressed	*-	16	21	-
	Implementing	-	40	38	-
	Interested	67	32	31	60
	Not Interested	5	6	6	9
2013	Completed	3	-	-	3
	Currently addressed	-	2	3	-
	Implementing	-	6	4	-
	Interested	10	6	6	8
	Not Interested	1	0	0	2

*Categories were not included in the workshop.

Table 5. The session I workshop provided information on GAPs that would be useful in the following categories by participants in 2012 (n=119) and 2013 (n=19).

	Number of Response (n)	Conducting farming practices that incorporate GAPs either informally or formally	Communicating about GAPs and food safety issues with others in my operation	Working with other group or individuals on issues related to GAPs, food safety and direct marketing issues
2012	*NR	5	3	4
	Strongly agree	39	44	40
	Agree	62	64	65
	Neutral	13	8	9
	Disagree	0	0	1
2013	NR	4	4	4
	Strongly agree	10	10	11
	Agree	4	2	1
	Neutral	1	3	3

*NR means no response.

Table 6. If the goal of the workshop has been met in session I workshop 2012 (n=119) and 2013 (n=19).

Number of Response* (n)	The goal of workshop that was met	
	2012	2013
Strongly agree	35	10
Agree	76	7
Neutral	3	1

*No response disagreed, and 5 people from 2012 and 1 person from 2013 did not respond.

Table 7. Profession of participants in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.

Profession	Percentage and Number of Response (n)		
	II-2012	III-2012	III-2013
Farm owner	27.8% (15)	66.7% (4)	30.4% (7)
Farm employee	9.3% (5)	0%	17.4% (4)
Farm foreman or manager	29.6% (16)	16.7% (1)	17.4% (4)

Manager (Farmer's market/ packer/ food distributor)	1.9% (1)	0%	8.7% (2)
Employee (Farmer's market/ packer/ food distributor)	1.9% (1)	0%	4.3% (1)
Field consultant	5.6% (3)	0%	8.7% (2)
Research/ Extension	3.7% (2)	0%	0%
Other	13.0% (7)	16.7% (1)	13.0% (3)
Student	1.9% (1)	0%	0%

Table 8. The status or interest of participants for the farming systems in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.

	Number of Response (n)	Performance of a GAPs Assessment	Performing aspects of GAPs	Recordkeeping for GAPs	GAPs Third-Party Certification
Session II 2012	Completed	10	-	-	13
	Currently addressed	*-	14	17	-
	Implementing	-	23	19	-
	In-Progress	24	-	-	10
	Interested	17	14	16	26
	Not Interested	0	0	0	2
	Status has changed since first GAPs workshop	18	21	20	13
Session III 2012	Completed	1	-	-	2
	Currently addressed	-	2	2	-
	Implementing	-	4	4	-
	In-Progress	4	-	-	1
	Interested	2	0	0	3
	Not Interested	0	0	0	0
	Status has changed since first GAPs workshop	3	4	4	2
Session II 2013	Completed	5	-	-	5
	Currently addressed	-	7	5	-
	Implementing	-	12	14	-
	In-Progress	14	-	-	7
	Interested	4	2	3	5
	Not Interested	1	1	1	6

Status has changed since first GAPs workshop	9	11	11	5
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*Categories were not included.

Table 9. Categories of information from the workshop that would assist participants' business in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.

Category	Number of Response (n)		
	II-2012	III-2012	II-2103
Gain new customers	22	3	10
Enter new markets	14	3	8
Create new jobs	6	1	3
Keep existing customers	30	4	15
Create new products	4	0	2
Retain jobs	12	1	4
Retain/reestablish lost customers	5	0	3
Create new services	6	0	1
Avoid unnecessary investments	17	0	6

Table 10. If the goal of the workshop has been met in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.

Number of Response* (n)	The goal of workshop was met		
	II-2012	III-2012	II-2013
Strongly agree	16	2	14
Agree	27	4	7
Neutral	3	0	2

*No negative response for all sessions, and there were 8 people did not respond in session II 2012.

Table 11. Progression on food safety practices related to overall GAPs program and personnel in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.

Number of Response (n)	Implemented Prior to Workshop 1			Implemented After Workshop 1			Intended to Implement			Not Applicable		
	II 2012	III 2012	II 2013	II 2012	III 2012	II 2013	II 2012	III 2012	II 2013	II 2012	III 2012	II 2013
Overall GAPs program	17	2	9	6	1	1	19	2	8	1	0	2
Employee Training	24	3	12	8	5	2	9	0	6	5	0	1
Recordkeeping	27	2	11	5	3	2	13	1	6	1	0	1
Risk Assessment	19	2	10	6	2	5	17	0	5	1	0	1
Worker Health & Hygiene Training	31	3	11	5	4	0	7	0	9	2	0	1
Worker Health and Hygiene Facilities Monitoring	22	3	9	6	3	0	17	2	10	1	0	1
Adding or Changing Hygiene Signs	18	2	9	6	3	2	18	1	9	2	0	1
Traceability Activities	24	2	11	3	1	1	16	3	6	1	0	3
Received 3rd-party certification for GAPs/GHPs/food safety	17	2	8	1	1	1	19	3	6	3	0	5

Table 12. Progression on food safety practices related to water, manure, and sanitation in session II (n=54), III 2012 (n=6), and session II 2013 (n=23) workshop.

Number of Response (n)	Implemented Prior to Workshop			Implemented After Workshop			Intended to Implement			Not Applicable		
	II 2012	III 2012	II 2013	II 2012	III 2012	II 2013	II 2012	III 2012	II 2013	II 2012	III 2012	II 2013
Water Source Assessment	24	2	10	4	1	3	15	1	7	2	2	1
Irrigation Water Testing	21	1	9	2	2	1	19	3	10	3	0	1
Manure Management	13	1	9	0	2	2	6	0	6	22	2	4
Composting Standard Procedures	12	1	8	1	2	1	9	0	7	20	2	5
Harvest Sanitation	27	2	10	3	4	3	13	0	7	3	0	1
Storage Sanitation	25	2	8	4	4	2	10	0	7	4	0	3
Transportation Sanitation	25	2	8	2	4	3	11	1	7	4	0	3
Wildlife and Animal Assessment	14	2	11	6	5	1	17	0	8	5	0	1
Wildlife and Animal Monitoring	15	2	11	6	3	1	18	1	7	4	0	1
Pest Control	31	3	15	4	2	3	7	1	1	1	0	2
Chemical Storage Assessment & Monitoring	28	3	14	6	2	2	7	0	1	4	1	3

PROJECT #20

Project Title: Tree Fruit Industry Fruit Frost Forecast

Partner Organization: Washington State Horticultural Association (WSHA)

PROJECT SUMMARY

When the major sponsor for spring tree fruit frost forecasts decided to opt out of continued sponsorship, *Clearwest*, a company created by three retired former Central Washington National Weather Service forecasters – with many years of experience in the tricky business of predicting springtime weather – turned to the industry for financial support. Nobody possessed the experience of predicting spring frost events that the three *Clearwest* owners possessed. The industry expressed a desire that access to this critical information be continued. The additional purpose of the project was to gather metrics on program usage and to procure funding to insure the future of the forecasts.

Spring frosts and freezes can kill the fruit buds, without which, there are no crops for that year. Advance notice of when and if critical temperatures will be reached is vital for growers who may then make preparations to combat these temperatures by using wind machines, water or supplemental heating or combinations of all three. When the major sponsor was lost, the first cutback to the overall program was the loss of the ‘Arctic Outbreak’ forecasting which ran from Nov. 1 through March 30 each year. The second cutback to the program was the loss of the morning forecast which tended to be the advance warning for the late afternoon forecast which was the most critical one to be maintained. Damage to stone fruit buds (cherries, peaches, apricots and nectarines) occurs in temperatures above those that may damage apple and pear buds. Hence, the ‘Arctic Outbreak’ forecast – a winter advisory of cold temperatures descending upon the growing areas – was of great importance to the stone fruit growers.

The second key factor is that the Central Washington tree fruit growing area is diverse with very different geographic and climatic conditions being present. North-south running river valleys intersect with west-east river valleys with significant elevation differences; hence, weather conditions in very small geographic locations can be very different from those just a few miles away. Temperature inversions, wind patterns, dew points, cloud cover, etc. must all be evaluated to determine when and if critical temperatures will be reached in diverse growing areas spanning roughly 250 miles north to south and approximately 1- 100 miles east to west!

PROJECT APPROACH

The goal of the project was to:

1. Provide the late afternoon/evening fruit frost forecast which was being provided;
2. Add back the morning forecast which was very important to grower preparedness;
3. Add back the ‘Arctic Outbreak’ forecasts covering the Nov. 1-March 30 winter period;
4. Procure permanent funding to insure the future of the program.

With approximately $\frac{3}{4}$ of the annual program cost coming from SCBG funds, the balance - \$11,000 annually, was provided by industry sources. Goals 1-3 were achieved and the full program continues to be offered even after the grant funds were no longer available. Efforts to provide full funding continue with additional partners being sought.

Through surveys conducted at grower meetings, the project was able to determine just how significantly the forecasts were being used. In addition, data from *Clearwest*’s ‘800’ phone line was used to determine the number of calls that were received to access data, as well as the number of ‘hits’ to their website where the weather information was also posted. Both revealed significant awareness of this group and actual use of it.

A collateral impact that is difficult – if not impossible - to determine is the extent to which other commodities also use and benefit from the available information. Fruit growers who are also wine grape growers report anecdotally that they also use the weather forecasts to determine when/if protection is needed. Collaterally, it is reported that many backyard gardeners use the report to protect their early season garden vegetables.

During each of the two years of the project, WSHA and its project partners provided financial support of \$11,000 annually. In addition, WSHA staff managed the project and met frequently with *Clearwest* operators to gather quantitative data and confirm compliance with the project goals and deliverables. Project partners in addition to WSHA who also provided financial assistance were: NW Farm Credit Services, Washington Growers Clearing House, Bleyhl Farm Services, NW Wholesale, Inc., Yakima Pom Club, NCW Fieldman's Association, Wenatchee Valley Traffic Association and Yakima Valley Grower/Shippers Association.

The information provided would only have had direct benefit to specialty crop growers since the weather forecasts were designed for growers of those crops and there are no other crops grown in these areas that could benefit from this information.

GOALS AND OUTCOMES ACHIEVED

For the two years covered by the project, *Clearwest* faithfully prepared and disseminated the 'Arctic Outbreak' forecasts as well as providing the morning and afternoon detailed area forecasts. WSHA staff met frequently with *Clearwest* to access information relative to 'hits' on their 800 telephone number as well as tracking 'hits' to their website. As referenced in prior reports in detail, surveys indicated a high degree of awareness of these forecasts. For example, 77% of those surveyed indicated they used the service; by a measure of about 4 to 1, the preferred method is to use the website as opposed to the toll free telephone number. As should be expected, during years with frequent frost events, usage by either contact method increases over those years where the spring is relatively frost free.

The only long term goal that is yet to be fully realized is to secure long term funding. While the *Clearwest* has been fully funded since conclusion of the project, efforts are still being made to obtain long term commitments for funding. WSHA staff believes this goal will be reached.

As noted in the Expected Measurable Outcomes in the WSHA proposal, measuring crop loss from frost is nearly impossible. The aggregate results are often seen when viewing annual production information and especially so in years where there is both significant frost event(s) and observable damage to the buds. What can be said with a fair degree of certainty is that without the reporting efforts, greater damage is likely to ensue. The information afforded allows for adequate preparation but damage can still occur when critical temperatures are either reached or exceeded for an extended period of time. Failure of growers to be prepared, wind machines that experience mechanical problems rendering them inoperable, pumps that suffer mechanical or electrical interruption or fuel tanks that run dry can all result in damage that is beyond the scope of this project. As noted above, metrics concerning awareness and usage were compiled. Website 'hits' varied based upon the severity of the frost season but ran from a low of 53,044 hits to a high of 72,637 during the 2008-2012 five year time period studied.

BENEFICIARIES

The benefits are difficult to calculate. With bud damage comes crop loss; growers are directly impacted by the loss of some portion of their crop. Packers have less fruit to pack so they, too, are negatively impacted. Packers are paid based upon the number of units packed, so if this is reduced, there is impact. Likewise, marketers are paid upon the number of units sold so crop reduction impacts them. Orchard workers have less hand thinning with reduced crops and fewer cherries, peaches, apricots, pears and apples to pick. Consumers are likely to feel the fruit shortage in the form of higher retail per pound prices.

It would be fair to say the grower is impacted most negatively for many costs are fixed costs and go on whether the grower has a crop or not. For example, the orchards must be pruned annually regardless of crop size the prior year. Insurance, taxes, fuel, crop protection measures aimed at insects and diseases continue, fertilizers, etc. go on annually; they are truly fixed costs.

Direct economic impact is difficult to gather for the reasons noted above. The service was made available to the entire industry with the addition of the two services that had been previously cut prior the grant.

LESSONS LEARNED

The project allowed for the adding back of services that had been previously cut for budgetary reasons in the form of the winter 'Arctic Outbreak' forecasts and the morning forecast during frost season. Those additional services have been maintained through private funding sources and have not had to be reduced; to continue the full level of services and fully fund them from sustainable sources continues to be a priority.

Users tend to forget the relative importance of a fruit frost forecasting program. When a clear frost event is upon the grower, the service is needed and vitally important. When frost season passes, it takes on less significance and funding sources tend to dry up. What has been learned is to secure firm funding commitments in advance of frost season!

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ADDITIONAL INFORMATION

All funds from the grant (\$62,000) and match cash funds (\$20,000) were expended in paying *Clearwest* for the services contracted for and performed. WSHA provided grant administration services as in-kind and consisted of providing WSDA with quarterly reports, billing and collection of cash match funds and meeting with *Clearwest* to manage their agreed service deliverables and insure grant compliance. WSHA staff prepared, disseminated and collected the survey questionnaires and compiled results.

The website for *Clearwest* may be found at: www.clearwest.com

END OF REPORT