Missouri Department of Agriculture
Specialty Crop Block Grant Program
USDA AMS Agreement 12-25-B-1471
Final Report

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Table of Contents **Page**

Project 1: Get Growing Kansas City-Missouri Program

Cultivate Kansas City
Katherine Kelly
Final Performance Report

Project Summary

Cultivate Kansas City, in partnership with KC Community Gardens and Lincoln University's ISFOP, worked with specialty crop farmers and potential farmers to help them start, expand, and operate their farms more productively and sustainably. We established and strengthened networks of community members and growers in order to build advocacy capacity for specialty crop production and consumption. Over a two year period, we helped 41 growers begin to sell their produce, including small scale gardeners selling excess produce and individuals/ organizations selling produce as a formal business venture. We assisted in the start-up of 17 food projects, which could include growing for sale, growing for donation/ personal consumption, food and nutrition education, gardening/ farming education, marketing of locally grown produce, increasing food access through addressing cost, physical location, or diversification of types of fruits/vegetables produced or available. We addressed water management through one-on-one TA, workshops, assisting the Water Services Department of KCMO in setting up the Grow KC water fund to assist farms and community gardens with sustainable water access and management strategies. We launched a metro-wide map that shows community/charitable/educational gardens, farms, and farmers markets and provides data for analysis of changes in the urban food system.

Project Approach

The production and consumption of fruits and vegetables has become of critical importance because of obesity rates in Missouri and nationally and the impact of obesity on physical health, productivity, and quality of life. Climate change also has brought issues of food production to the fore; in order to address climate change's impact on food availability, we need a broader base of growers, both home-scale and commercial growers, who are competent, and constantly learning and expanding their growing and distribution skills.

Helping more people learn how to grow food and how to share their knowledge with others thus increasing the awareness and demand for locally grown vegetables;

- Increasing urban farms, community gardens, school gardens, and home gardens, thus increasing the production of specialty crops
- Increasing the skill level of farmers and gardeners thus increasing the quality and competitiveness of specialty crops;
- Establishing long-term relationships between community based organizations, community leaders and farming and gardening organizations thus insuring long-term competitiveness and sustainability of local vegetable production; and
- Establishing a strong advocacy network for fresh food and eating healthy thus increasing competitiveness, improved distribution, and increased quality of locally grown specialty crops including vegetables, flowers, herbs and fruits.

The Get Growing KC program addresses both of these issues, building the grassroots knowledge base and numbers of growers at the same time increasing the knowledge of elected officials and governmental staff and increasing public demand for healthy fruits and vegetables.

Activities

Public Outreach to engage people in specialty crops in MO through education, action: public talks, tabling events, individualized outreach

Goals: 80 talks/ outreach events
Accomplished: 38 public outreach events; 260 people reached

Workshops: Educational workshops geared to growers, both gardeners and farmers, to help them become growers, become better growers, more sustainable growers

Goals: How to Start an Urban Farm, Water Catchment & Access, Greenhouses & Cold-Frames, Wholesale Success
Accomplished: 15 workshops, 148 attendees (may include duplicates)

Technical Assistance to Existing and Potential Farmers: one-on-one TA to farmers on production, land, marketing, business management, and any other issues of relevance to the growing and distribution of fruits and vegetables.

Goals: 54 potential farmers reached; refer 60 growers to other agencies
Accomplished: 56 potential farmers reached; referrals were not tracked, it proved to be too cumbersome and the numbers were not reliable.

Total hours of TA provided: 693 hours (includes TA to food projects)

Technical Assistance to Existing and Potential Food Projects: one-on-one TA in support of food projects growing for sale, growing for donation/ personal consumption, food and nutrition education, gardening/ farming education, marketing of locally grown produce, increasing food access through addressing cost, physical location, or diversification of types of fruits/vegetables produced or available.

Goals: not specified
Accomplished: We provided TA to potential and actual food projects, with the hours included above.

Develop Materials and Curriculum:

Goals: materials refined, other materials produced as needed.
Accomplished: We continued to refine our presentations and the materials we share with growers. These include for-profit and not-for-profit farm budget templates, water audits and supporting materials, others.

The Get Growing team members worked almost exclusively on fruit and vegetable crops; any work that was done, for example urban chickens, was so limited as a percentage of the total project that we can safely say that no SCBGP funds were used to support that work, given the overall costs of the program.

Goals and Outcomes Achieved

All activities were tracked through an online database; results were tracked through informal surveys (i.e. continued relationships with TA recipients and direct knowledge of their projects) rather than participant and follow-up surveys. The Get Growing KC Map, http://maps.cultivatekc.org/, has been published and maintained as a measure of gardens and farms and food projects across the metro area.

Public Outreach: public talks, tabling events, individualized outreach
Goal: Reaching 3,000 people through 1,500 presentations in Missouri about specialty crops and the importance of growing and eating food locally;
Accomplished: 260 people introduced to Get Growing, specialty crop production, urban agriculture, as well as attendees at workshops below. This original goal was set too high.

Workshops: Educational workshops geared to growers, both gardeners and farmers
Accomplished: 148 attendees (may include duplicates) learned about specialty crop production, distribution, consumption

Technical Assistance to Existing and Potential Farmers: one-on-one TA to farmers on production, land, marketing, business management, and any other issues of relevance to the growing and distribution of fruits and vegetables.

Goals: 10 new urban farms selling specialty crops; 20 community gardeners and home gardeners beginning to sell specialty crops on-site or through farmers markets; 3 gardens or farms established on public land; 7 empty lots to be rented or purchased for use as gardens or farms.; support growers in transforming land into productive green space.
Accomplished: 40 new farmers (including gardeners selling excess); estimated 3 acres plus in production including 4 publicly owned rented lots; community gardeners selling excess included in “new farmers” numbers; 1 community garden selling on site; new all production sites were a transformation of vacant land into productive green space.

Goals: 6 new farmers bringing 3-6 acres into production; 20 utilize other agencies’ services; 30 community gardeners sell excess produce; 4 community gardens sell on-site.
Accomplished: 40 new farmers (including gardeners selling excess); estimated 3 acres plus in production; referrals were not tracked; community gardeners selling excess included in “new farmers” numbers; 1 community garden selling on site.

Technical Assistance to Existing and Potential Food Projects: one-on-one TA in support of food projects growing for sale, growing for donation/ personal consumption, food and nutrition education, gardening/ farming education, marketing of locally grown produce, increasing food access through addressing cost, physical location, or diversification of types of fruits/vegetables produced or available.

Goals: 15 new food projects started

Accomplished: 27 new projects started, including a farmers market, that was started in a food desert in Raytown, MO, neighborhood based food production planning project, others.

Develop Materials and Curriculum:
Goals: materials refined, other materials produced as needed. Accomplished: materials produced

We will continue to work with the growers who started farming/ started selling produce with assistance from this project and the food projects which began. We also know that, based on experience, some number of the potential farmers and food projects we worked with that did not begin during this time period will emerge at a later date.

Beneficiaries

Gardeners, urban and peri-urban farmers, consumers, farmers markets, neighborhood and community based organizations, elected officials and city staff (specifically through education and provision of information).

An estimated 872 people received direct services, education, or support. They received one-on-one technical assistance in growing, in production, marketing, or management of their farm business, in food/ nutrition education, in land access, in site assessment and development, in developing sustainable water management practices, and in project development, which generally included strategic planning, assessment, and implementation of strategies. They also attended workshops, tours, talks, or outreach events where they learned about specialty crops.
These numbers do not include the number of people who ate the food produced by the growers we assisted.

Lessons Learned

As we begin to address food production in a more comprehensive, systemic way, we are seeing more urban and peri-urban food projects and farms that blur the “traditional” lines between garden and farm, community-directed and commercial. Working in a collaboration of organizations that have expertise at different points on the spectrum is sometimes wonderful and sometimes challenging because of very real differences in process, goals, and systems. We are, together, trying to develop a different kind of food system that provides the fruits and vegetables that people need on their plates every single day, so understanding the constraints and approaches of all the growing partners is important and worth some persistence.

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Project 2: Missouri River Bluffs Specialty Crops Regional Marketing Program

Missouri River Bluffs Association (MRBA)
Steve H. Johnson
Final Performance Report

Project Summary

The goal of this project was to create public events where growers could come together and meet local customers interested in buying locally grown specialty crops. The Kellogg Foundation estimates that the average item of food on our local grocery store shelf has traveled 1,500 miles in order to arrive there. When a central Missouri resident buys that food item, most of the money paid for that food immediately leaves our region and travels the 1,500 miles back to where it was produced. The more food that can be grown here in central Missouri the fewer resources are wasted, local consumers will have fresher and tastier food, and more money will be staying here in central Missouri thus building a healthier economy for all. The market for healthy food is growing every day. One of the best ways for individual consumers to insure that they are getting healthy food is to meet the producers who are growing that food, create a relationship with the growers and ask them questions about how the food is grown. This only happens if one starts buying food from local markets where you can talk to those producers.

Project Approach

MRBA ensured that no SCBGP funds were used to pay for entertainment expenses. We did have music at every Festival. Almost all musicians at the Festivals played for free. A generous donor paid for the musicians at one of the events and a donor paid for the sound system at a second event. No SCBGP funds were used for entertainment expenses.

For children's activities MRBA raised private funds to pay for expenses related to buying the supplies not allowed by Specialty Crop Grant funds (paints, hay bales, etc.). The Farmers Market Festival staff purchased (or solicited donations) of $100 worth of vegetables to use for carving or stamps for children's activities. Another $200 in Specialty Crop items were purchased from vendors at the Festivals to be used in educational activities educating children about unusual crops that they may have never seen and used to help them understand how people prepare the crop to eat. These were used to demonstrate cooking the items, showing cooking techniques and allowing children to sample the food item. No SCBGP funds were used to purchase crops for entertainment purposes as defined by USDA guidelines. No SCBGP funds were used to purchase any supplies related to children's activities. We changed our plan for children's activities when a retired teacher volunteered to provide children's books about food at the Festivals and read to children during the Festival Event. She volunteered her services and bought all the books herself (or had them donated through the Missouri State Teachers Association).

Specialty crops highlighted during the Missouri River Bluffs region market cooking demonstrations were as follows: Adam Puchta Vignoles wine; Spaghetti squash with kale; Stone Hill Norton wine; Walk About Acres Honey dressing; Les Bourgeois Brut wine; Grilled

carrot salad; Tomato basil bisque; Pesto; Sauerkraut; Blackberries for gelato; Gazpacho with green peppers, tomatoes, cucumbers, onions, and jalapeno peppers.

"Beer" was mentioned in The Taste of Local Missouri website and the postcards and posters that were printed to promote the Festivals contained the word "beer". The cost for these promotional items is $462. To date, MDA has not reimbursed Missouri River Bluffs for these costs. We plan to work with MDA on an equitable reimbursement for these costs.

Some of the advertisement as a whole is an unallowable expense because of generally promoting the Taste of Local Missouri Food at festivals. The Missouri River Bluffs Specialty Crops Regional Marketing Program will use Specialty Crop Block Grant program funds for the portions of the advertisements that solely promote the fruits and vegetables sold at the festivals. Where printed advertisements list multiple items, the Missouri River Bluffs Specialty Crops Regional Marketing Program will divide the total cost by the number of items being advertised and request reimbursement for only the percentage of costs that solely promotes specialty crops. We will provide MDA with the proper documentation to illustrate how we determined the cost.

The Missouri River Bluffs Specialty Crops Regional Marketing Program provided the matching funds to cover the costs of ineligible commodities.

Regional Producers and Market Networking

- Creation of a database of all Farmers Markets, food producers and retail outlets that offer locally grown food in the 5 county region; We have about 150 local food producers or retail outlets for local food in our 5 county area. We are continually researching new producers and retail outlets for locally grown food in the five county areas. We are constantly adding new businesses to this database as we learn about food producers and local food retail outlets.
- Staff will contact all Farmers Market coordinators, food producers, restaurants and food stores that sell locally grown food and enlist their participation. Our AmeriCorps VISTA members contacted all Farmers Market coordinators in the five county area. We worked with the Farmers Markets to connect with local producers. We also worked with local producers to discover the restaurants and retail stores who were selling locally grown food.

Missouri River Bluffs Local Food Map

The Missouri River Bluffs Local Food Map was published in December 2013 and 2,000 copies were printed. We are in the process of distributing these Local Food Maps to local food producers and businesses who utilize local food in our 5 county Missouri River Bluffs Region.

Six Market Day Regional Food Festivals

All six Food Festivals have been organized and completed.

County	Location	Day and Date	Time
Callaway County Completed	Veterans Park, Fulton, MO	Saturday, May 11, 2013	

Moniteau County Completed	Downtown California, MO	Saturday, June 22, 2013
Osage County Completed	City Park, Linn, MO	Saturday, July 27, 2013
Cole County Completed	Jefferson City, MO	Saturday, August 24, 2013
Boone County Completed	Columbia, MO	Saturday, Sept. 7, 2013
Cooper County Completed	Boonville, MO	Saturday, October 12, 2013

Photos from the six Taste of Local Missouri events are posted at the following locations:

http://www.moriver.org/market

https://www.facebook.com/TheTasteOfLocalMissouri/photos_stream

https://www.facebook.com/tasteoflocalmissourijc/photos_stream

Missouri River Bluffs Region Market Cooking Demonstrations

Laura Carter organized and performed cooking demonstrations at all six Taste of Local Missouri Food Festivals on these dates:

1. Saturday, May 11 at the Callaway County Taste of Local Missouri Festival in Fulton's Veteran's Park.
2. Saturday, June 22 at the Moniteau County Taste of Local Missouri Festival in California, MO.
3. Saturday, July 27 at the Osage County Taste of Local Missouri Festival in Linn, MO City Park.
4. Saturday, August 24 Cole County Taste of Local Missouri Festival in the Munichburg Festival area on Dunklin Avenue in Jefferson City.
5. Saturday, September 7 at the Boone County Taste of Local Missouri Festival in Flatbranch Park in Columbia, MO.
6. Saturday, October 12 at the Cooper County Taste of Local Missouri Festival in Kemper Park in Boonville, MO.

Publicity for the Taste of Local Missouri Food Festivals

- Laura created a **Taste of Local Missouri website** that is promoting all six of the Taste of Local Missouri Festivals and can be viewed at: http://tasteoflocalmissouri.com/ .
- Laura also created a **Facebook page** to promote the festivals which can be viewed at: https://www.facebook.com/pages/Missouri-River-Bluffs-Association/141740835893919?ref=hl
- Laura has posted more than 200 posts to the website and Facebook pages in the last two and one half months, (at least two times each day).
- Laura also posted information on the Missouri River Bluffs Association website and Facebook page http://moriverbluffs.org/

- We produced an information sheet describing the goals and objectives of the Taste of Local Missouri Food Festivals, information about MRBA and a schedule of each of the Festivals that we handed out at each of the three events.
- We produced a poster that we use as a template and created a new poster for each of the Taste of Local Missouri Food Festivals in all six counties.
- We printed 5,000 copies of a 3"X5" postcard with the Festival logo and the schedule on the back to distribute.
- We created a Festival Planning Committee in each of the Counties where we organized a Festival.

Missouri River Bluffs Association Regional Social Media Campaign

The Taste of Local Missouri Food Blog is called "*MO Deep Roots: Your Mid-Missouri Guide to Local Food"* and can be found on the internet at this address: http://www.modeeproots.com/.

The person working on the social media campaign is the "cooking video personality" Laura Carter. Laura continues to make posts on the MODeepRoots.com website as well as on the Missouri River Bluffs Facebook page, the Missouri River Communities Network Facebook page and the Taste of Local Missouri Facebook page. She also posts information about the recipes that she has featured in her cooking demonstrations at all six Taste of Local Missouri Food Festivals.

Missouri River Bluffs Region Market Cooking videos

We contracted with Laura Carter to create, produce and publish eleven cooking videos. All eleven of the videos are completed, posted to the internet, and can be viewed at this address: http://www.modeeproots.com/category/food/cookingvideos/ and also posted on the MODeepRoots website at http://www.modeeproots.com/.

The cooking videos have been viewed more than 740 times since they were published. They are also being shown on the Columbia educational channel through the regular CATV programming. CATTV was a significant partner on this project, helping by loaning us equipment, providing training, technical advice and helping us get our finished product on the air.

Supporting Organizations

We had significant help and support to implement the activities in this project by the following organizations:

- The Members of the Missouri River Bluffs Association - Coordinating the grant
- Missouri River Communities Network - Administering the grant activities
- Missouri Local Food Production & Education VISTA Project - Provided staffing for the grant activities
- Columbia Area Television - Provided training for video; loaned use of camera; use of video editing
- KOPN Radio Station - Traded booth space for radio promotion of Festivals
- Fulton Brick District Organization - Partner in the Callaway Taste of Local MO
- Fulton Public Works Department - Hung the banner over Business Highway 54 in downtown Fulton

- California Progress Incorporated - Non-profit that co-sponsored the Festival in Moniteau County
- California City Council - Worked with us on closing the city street for Festival
- Linn Missouri City Council - Co Sponsored the event; donated use of the City park
- Linn Mayor Dwight Massey - Enthusiastic supporter who helped make it happen
- Osage County Extension - Kathy Dothage helped make the event successful
- Jefferson City Parks and Recreation Department - Donated the use of a mobile stage
- Jefferson City Police Department - Helped us close down the street for six hours during the event
- Old Munichburg Association, Jefferson City, MO - Partnered in sponsoring the event.
- Lincoln University Farmers Market - Helped with publicity and promotion
- Jamie Shepard of Shep's Southside Restaurant - Helped coordinate event, promoted on radio
- Ecco Lounge Jefferson City - Helped promote the event;
- Karen Chandler, Columbia Parks and Recreation Department - Helped secure use of FlatBranch Park
- Brad Wooldridge, Wooldridge and Wooldridge, Boonville, MO - Loaned us use of the orange fencing
- Accent Press, Columbia, MO - Printed posters at half price
- Green Thumb Project, Kirksville, MO - Provided volunteers to help set up and tear down in Boone County

Goals & Outcomes Achieved

We completed every activity that we set out in our goals narrative. The only item where we were slightly under our goal was in the printing of the Local Food Map. Originally we intended to print 8,000 copies of a 17" X 20" map. Instead we printed 2,000 copies of an 8.5" X 11" map. The map was originally going to have a GPS based point location for every local food producer/vendor in the five county areas with their name and address on the back of the map. We realized soon that producing this kind of map was going to be significantly more expensive than we had resources in the grant to invest. Therefore we downsized the map project itself. We also printed fewer maps since we did not have the map ready until the end of the growing/farmers market season.

Somewhere around 2,000 citizens attended the six Taste of Local Missouri Food Festivals. We had around 10 to 20 vendors who sponsored booths at each of the six events. Each event had local food producers selling locally grown specialty crops.

The MODeepRoots Facebook page and website were somewhat successful but not hugely popular. The Facebook page has 158 likes. When Laura posts information she has between 50 and 80 people that open up and read the post. When she uses the "promoted posts" she has about 1,000 people who open the information. Laura recommends that with regard to website information, not to focus on recipes, since there are so many sites out there with recipes. She thinks a better goal for a website is information sharing. People can find information about specific local food producers and where they can find locally grown food.

The most clear indication about the success of the project is that since the last Taste of Local Missouri Food Festival, MRBA has received more than a half dozen inquiries asking when we are going to start planning for this event in their community next year. At this point MRBA

believes that it would be nice for the festivals to occur, but it won't be MRBA and Missouri River Communities Network (MRCN) actually organizing, coordinating and staffing the events. We are contemplating requesting funds to organize two or three one-day workshops inviting interested communities to send representatives to learn about how we organized the events. We hope communities will pick up the task and work on organizing the Festivals themselves.

MRBA is currently collaborating with a class of graduate students in Rural Sociology at the University of Missouri-Columbia. They conducted a survey of all contacts we connected with through our 6 Taste of Local Missouri Food Festivals. This includes community organizers, elected officials, producers, vendors, city staff, customers and people who have visited our website. The results of that survey are very positive about the effect the Food Festivals had on enhancing the market for specialty crops in the participating counties. One of the University students has written a summary report of some of the survey results related to specialty crops in the six county region. See these survey results in Additional Information.

Here is a short summary of information we gleaned in talking with producers who participated with our Taste of Local Missouri Food Festivals:

In the Callaway Festival in Fulton, I spoke to the woman who is the primary leader of the Fulton Farmers Market who indicated that the Callaway County Local Food Festival generated a great deal of interest in the community and that the Fulton Farmers Market had a very successful year after the Festival, growing both in number of producers selling at the market as well as the amount of produce sold.

In the Moniteau County Festival, there is no Farmers Market in California, MO so our Festival was virtually the only Farmers Market that took place in California last summer. The Festival certainly increased sales for farmers in the California area who participated in our event.

At Linn, MO in Osage County the two women (who are the only vendors who sell at the Linn Farmers Market) talked to me at the end of our Osage County Festival and said that they had sold two times as much produce in the one day of our festival than they normally sold all day at their regular Linn Farmers Market. The Mayor of Linn was thrilled at the success of the Food Festival and is urging us to help them host a second Festival this summer.

In Jefferson City, two MRBA members who had booths at the Festival (and have businesses in the Jefferson City area) communicated to MRBA that the event was a solid success and that they wanted to make sure that the event happens again this next summer.

In the Columbia, MO Food Festival it was probably our biggest challenge in terms of growing the market for local food producers since the Columbia Farmers Market is such a very successful Farmers Market, with 4,000 to 5,000 customers attending the Columbia Farmers Market on an average Saturday morning during the height of the summer of 2013. But our Festival in Columbia certainly helped grow the number of producers introduced to the Columbia market since we had two vendors from the Fayette Farmers Market who hosted sales booths for the first time in Columbia, two vendors from the Owensville Farmers Market who hosted booths for the first time in Columbia and one school nutrition education non-profit organization from Kirksville, MO who hosted an information booth promoting their project. In addition, we had 10 producers who normally sell at the Columbia Farmers Market who hosted a booth at the Columbia Taste of Local Missouri Food Festival.

With regard to the Cooper County Taste of Local Missouri Food Festival in Boonville, the

Festival itself occurred after the Boonville Farmers Market closed for the winter. So there is no information about what kind of affect our Festival had on sales or participation at the local Boonville Farmers Market. We hope to have some information as a result of the attitude survey we are working on with the University of Missouri Columbia.

As a result of the Taste of Local Missouri Food Festivals in 2013, MRBA had 10 new producer members join our regional association. In addition we had four non-profit organizations that joined our regional association so they could participate in the Local Food Festivals.

There is certainly more awareness amongst citizens of our food producers in each county within the Missouri River Bluffs Association area. Now these consumers have a better idea where they can find locally grown food.

Beneficiaries

Beneficiaries include specialty crop food producers in each of the six counties where Festivals were held; residents of those six counties gained a better understanding of who is growing food in their county and where they can access that food; restaurants in the counties who are serving locally grown food; and area Farmers Markets have received a higher profile which will translate into higher numbers of shoppers at local market.

Lessons Learned

Creating and updating a database is a constantly evolving task, with the end never in sight. New food producers are starting their business' every week, month, year, along with some producers leaving their business' as well.

The Local Food Map was significantly more challenging than we had expected. First we had to contact businesses to make sure they wanted to be listed on the "Local Food Map, since many producers do NOT want people showing up at their door asking for a "tour of the farm". Once we got the database narrowed down to those who wanted to be listed, we started the map making with a graduate student in Geography at the University of Missouri doing the work on taking our "local food producers/retailers" and pin-pointing them on a GPS map. He was able to work through most of the list by the end of the semester and then he was gone. We had to start over locating someone to do the entire map project.

Fortunately we found a volunteer with a master's degree in geography that was willing to work on the map. He redesigned the format and laid out the graphics. In future map making projects, I would caution that it will take significantly more dollars to create a map which pinpoints locations in a five county area. There are many challenges that require a professional cartographer and can't really be done with graduate students at a local university.

The Taste of Local Missouri Food Festivals was very popular with local producers and small business owners. They were very staff/volunteer intensive events that took a lot of planning, coordinating with local officials (health departments, city staff, elected officials, local food producers, etc.). We organized a planning committee in each county and held regular meetings to get local people involved. It worked better in some places than others. The day of the event was exhausting. We were usually onsite before 10AM setting up tents, fencing, stages, getting

port-a-potties placed, signage up, etc. And in most cases the weather was intensely hot. At least one staff person nearly suffered heat stroke. But county residents have expressed interest in trying to do the Festivals again this summer. We have decided that as an organization we will be able to help local organizations figure out how to do it themselves but that we won't be organizing the events ourselves.

Publicity for the Taste of local Missouri Food Festivals requires a fulltime public relations person working on getting information out to the public through news releases, interviews, appearances on radio and television stations, and articles in newspapers, social media of all kinds and listings in organization newsletters. We did some of this but the grant did not have resources for a staff person to do these tasks. Our VISTA members did some of this but we could have benefited from even more saturation.

Laura suggested that recipes are probably not the thing that gets people excited on social media. There are so many sites that do recipes that the area is overloaded. The social media area is used predominately by younger people, so the content needs to be more geared toward those young people who are interested. They are more interested in obtaining information about where to find local food, information about the farmers, and where they can go visit and talk with farmers.

I think I have addressed the lessons learned by our project staff. The overriding one was realizing the project was very ambitious and took a great deal more staff and volunteer energy than we anticipated. All of the Festivals occurred in the height of the heat wave in central Missouri in the summer of 2013. To replicate these activities, it will require significant numbers of dedicated volunteers in each community who are raising funds to pay for the cost of basic costs like: rental fees, port-a-potties, health department licenses, liability insurance, permits, street closures, etc.

One unexpected outcome was the interest in our festivals by food producers outside our 6 county project area. We had some vendors who came to our festivals who heard about our project and drove long distances to have a booth and sell food at our events. These people were obviously paying close attention to the market for locally grown food and saw the opportunity to expand their market into adjacent counties to their own.

I believe the goals and outcome measures of the project were achieved. Most communities are asking us when we are going to start organizing the next festival in their community. With regard to the social media portion, we were mildly successful. We learned that with regard to social media, it is a task that is constant. Once you have started building a social media contact group these members want to see and hear about constantly new and interesting issues regarding local food. If you don't continuously provide new information these "social media followers" will lose interest in your site and move on to another site.

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Additional Information

www.moriverbluffs.com

http://www.modeeproots.com/

Local Mid-Missouri Foods

This map shows a few locations where you can begin your Missouri River Bluffs local food adventure. Visit www.moriverbluffs.org and www.modeeproots.com for more info about these businesses and many other regional growers and producers.

Businesses that Produce or Use Local Foods

The more businesses in or near a town, the larger the icon appears. See the back of this map for details.

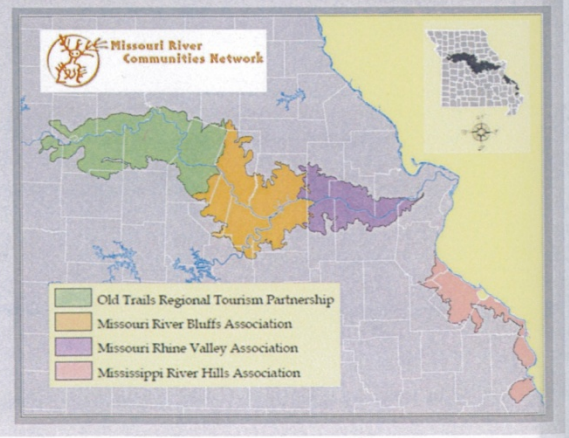
Town with one business

Town with a few businesses

Many businesses

MISSOURI River Bluffs ASSOCIATION

www.moriverbluffs.org
www.moriver.org
www.modeeproots.com



Produced by the Missouri River Bluffs Association and the Missouri River Communities Network with a grant from the Missouri Department of Agriculture. Map features are not drawn to scale; this map is an approximation and is not meant to be used for the purpose of navigation. Addresses for the businesses referenced by this map are listed by town on the reverse side of this map. Sincere thanks to all participants in the 2013 Taste of Local Missouri Project. This graphic and cartographic representation were produced by Rob Long.

Some of the locations where you can buy locally grown food in the Missouri River Bluffs region:

Ashland
Coyote Market Farm and Home, 106 Maple St
Heartland Family Nursery, 1795 E Hwy MM • 573-657-2562
*The Salad Garden, 16303 S Hawkins Rd • 573-657-1125

Auxvasse
Callaway Fields (plant nursery), 9731 Falcon Dr • 573-386-2329
*Deep Mud Farms • 573-826-5234
*Terra Bella Farm, 1303 State Road M • 573-642-6226

Bonnots Mill
*Thoenen Produce, 2669 Hwy C

California
*Hohenberger Fine Foods, 29437 Country Club Rd • 573-433-5085

Centertown
*Duncan Family Farm, 1000 Kaylor Bridge Rd. • 573-584-8083
Longfellow's Garden Center, 12007 Lookout Trail • 573-584-9611

Centralia
*Covered-L Farm, 18700 N Adams Rd • 573-682-5536
*Crocker Farms, 14400 North Rt Z • 573-682-5605

Chamois
*Paulsmeyer Produce, 10833 Hwy 100 • 573-301-0906

Columbia
There are many farmers in the Columbia area who are easiest to find at area farmers' markets, and are not listed below. See MODeepRoots.com for a more complete listing.

Boone County Farmers' Market, 1005 West Worley • 573-449-1631
*Columbia Center for Urban Agriculture, 209 Smith St 573-514-4174
Columbia Farmers' Market *(see web site for other locations)*, 1701 Ash (spring-fall), 601 Bus. Loop 70 W (winter) 573-823-6889
North Village Arts District Farmers and Artisans Market, 126 N 10th St
Bleu Restaurant and Bar, 811 E Walnut St • 573-442-8220
Broadway Brewery, 816 E Broadway • 573-443-5054
Café Berlin, 220 N 10th St • 573-441-0400
Comedor Popular--Centro Latino, 609 N Garth
Main Squeeze, 28 S 9th St • 573-817-5616
Pizza Tree, 1013 Park Ave • 573-874-9925
Sycamore, 800 E Broadway • 573-874-8090
Trey Bistro, 21 N 9th St • 573-777-8654
Uprise Bakery, 10 Hitt St • 573-256-2265
Wine Cellar and Bistro, 505 Cherry St • 573-442-7281
Clovers Natural Market, 2012 E Broadway • 573-449-1650
Clovers Natural Market, 2100 Chapel Plaza Ct • 573-445-0990
Hy-Vee, Columbia #1, 3100 W Broadway • 573-447-0133
Hy-Vee, Columbia #2, 405 E. Nifong • 573-442-8595
Hy-Vee, Columbia #3, 25 Conley Rd • 573-442-7703
Natural Grocers, 400 N Stadium • 573-445-6353
Patchwork Family Farms, 1108 Rangeline Rd • 573-449-1336
Pick and Pick (u-pick), 5910 S Rangeline Rd • 573-449-8031
*Pierpont Farms, 8810 S Route N • 573-499-9851
The Root Cellar, 1023 E Walnut • 573-443-5055
*Walk-About Acres, 6800 Kirchner Rd • 573-474-8837
Wilson's Garden Center, 909 Clinkscales • 573-445-2853

Fulton
There are many farmers in the Fulton area who are easiest to find at area farmers' markets, and are not listed below. See MODeepRoots.com for a more complete listing.

Brick District Farmers' Market, 5th St. (near Courthouse) 573-220-5618
Bek's, 511 Court St • 573-592-7117
*Birch Cove Katahdins, 4702 Birch Cove Dr • 573-642-7746
*Bluebird Composting, 4657 State Rd HH • 573-999-4082
Brooklyn Pizza, 501 Court St • 573-642-1122
*Harrison Valley Farm, 5199 County Road 351 • 573-642-8988
Kingdom of Callaway Vineyards, 6615 County Rd 401 573-592-0156
Serenity Valley Winery, 1888 County Rd 342 • 573-642-6958
Shepherdsfield Bakery and Country Store, 777 Shepherdsfield Rd 573-642-1439
Shyrock Callaway Farms, 2927 County Rd 253 • 573-592-0191

Hallsville
Hallsville Farmer's Market, 123 E Hwy 124 • 573-881-6205
Route B Greenhouse, 5475 E Parks Ln • 573-696-1100
Celtic Wyndes Farm and Shoppe, 106 Route B • 573-289-3127

Harrisburg
*Goatsbeard Farm, 11351 Callahan Creek Rd • 573-875-0706

Holt's Summit
Canterybury Hill Winery, 1707 S Summit Dr • 573-896-9966

Jamestown
*Happy Hollow Farm, 17199 Happy Hollow Rd • 660-849-2430
*Manitou Farms, 18523 Oakland School Rd • 660-849-2567
*Rocking P Ranch, 58624 Hwy U • 660-849-2513

Jefferson City
There are many farmers in the Jefferson City area who are easiest to find at area farmers' markets, and are not listed below. See MODeepRoots.com for a more complete listing.

Cole County Farmer's Market, K-Mart parking lot, 2304 Missouri Blvd • 573-392-3088
Lincoln University Farmer's Market, 1219 Chestnut St • 573-681-5385
The Grand Cafe, 107 E. High St • 573) 635-7842
JC Health Foods, 1406 Missouri Blvd • 573-636-9889
Shep's Southside, 112 E Dunklin St • 573-893-8600

Linn
Linn Farmers' Market, 920 E Main St • 573-619-8379

New Bloomfield
Cedar Crest Vineyards and Winery, 412 County Rd 398 573-230-6497
Prairie Garden Trust, 8945 County Rd 431 • 573-295-4220

Rocheport
Les Bourgeois Vineyards and Bistro, 12847 Hwy BB • 573-698-2300

Russellville
Russellville Farmer's Market, Lion's Club Pavilion Route C 573-782-4682

Tebbetts
*Invermos Valley Farms • 573-619-0167
Tebbetts Farmer's Market, Tebbetts Community Center 5401 County Rd 4011

*Products available at area farmers' markets, through CSA subscription, or by appointment. Please call or visit online; walk-in visits not recommended.
www.moriverbluffs.org | www.moriver.org | www.modeeproots.com

This food map is a project of the Missouri River Bluffs Association and the Missouri Department of Agriculture, Specialty Crops Grant Program, produced under a contract with the Missouri River Communities Network.

Web site: www.modeeproots.com • Email: laura@modeeproots.com

What is MO Deep Roots?

MO Deep Roots is the name (and URL) of a project of the Missouri River Bluffs Association and the Missouri Department of Agriculture, Specialty Crops Grant Program, to promote the use of locally grown fruits, vegetables, honey, and flowers. They signed me on as their "market chef" and spokesperson to spread the fresh-and-local word through this web site, social media (Facebook and Twitter), a series of short cooking videos that will be posted on this page, and live cooking demonstrations at all of their Taste of Local Missouri Food Festivals now through October. My mission is to build relationships between local food producers and their customers throughout the Missouri River Bluffs region (Boone, Callaway, Cole, Moniteau, and Osage counties).

Who am I?

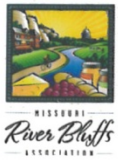
I'm Laura Carter, an avid gardener and farmers' market shopper who loves to cook "from the garden." Even though I share a large almost-year-round garden with my father, I love the diversity and the energy of farmers' markets so much that I tend to visit them even when I'm buried in produce of my own. They always have what I crave but didn't grow (peaches, sweet corn), or what I tried to grow but lost to bugs or drought. If it's in season, someone at a nearby farmers' market is bound to have it if I get there early enough.

I did not go to culinary school, have never cooked in a restaurant, haven't written a cookbook, and don't have a degree in nutrition, horticulture, or agriculture. I'm just a pretty good home cook who loves every imaginable type of vegetable and has fun finding ways to help others love them just as much. I'm the mom who always serves salad and veggie snacks instead of cookies; the family member who always brings the vegetable sides and salads to the pot luck suppers; the woman whose death row meal would have to be a big bowl of my own vegetable soup. In short, I'm fresh-and-local enthusiast who has just found a new way to share my passion, through MO Deep Roots and the Missouri River Bluffs Association.

What will you find on the MO Deep Roots web site?

- Recipes and tips for preparing fresh, local, and seasonal food, with an emphasis on fruits and veggies. Though I may sometimes post recipes I love that take a little extra time to prepare (like my favorite Pennsylvania Dutch chicken corn soup) or require a trip to the grocery store (in case you don't have any raspberry-infused balsamic vinegar, one of my new favorites), my main focus will be on simple, quick dishes that use readily available ingredients.
- I'll report on what produce is available at the various markets in the Missouri River Bluffs five-county region, and I'll let you know what to look for and where to find it. And of course I'll be sure to post recipes for whatever is hitting the market that week.
- Soon we'll be creating and posting a series of short cooking videos featuring me making some of the recipes posted on this site. Check back for the first one in a few weeks!
- I'm working on a comprehensive listing of every farmers' market, CSA, urban garden, market farmer/gardener, store, and restaurant that sells or uses locally sourced food so you'll know where to go to buy fresh and local.
- Over the course of the next few months I hope to introduce you to many of the people who grow and sell the food in our area. I've been getting to know a lot of them lately, and I think you'll like them as much as I do.

www.moriverbluffs.org | www. tasteoflocalmissouri.com
info@moriverbluffs.org



Calling Vendors, Restaurants, and Organizations for

The Taste of Local Missouri
Food Festivals

The Taste of Local Missouri Food Festivals are designed to help residents in the six Mid-Missouri counties of Boone, Callaway, Cole, Cooper, Moniteau and Osage increase their awareness and access to sources of healthy, locally grown fruits, vegetables, honey, herbs and flowers. At these festivals, people are invited to experience the taste of the best of the local food production market. We will showcase Local Food (fresh food and value added products), prepared specialty foods for sale, cooking demonstrations, Local Wine, Local Beer, Local Music, and Local Fun!

We are writing you today to invite you to be a vendor at any one or all six of The Taste of Local Missouri Food Festivals. We welcome your business, restaurant, or organization as a participant in these events. The first Taste of Local Missouri Festival will be held in Fulton, MO at the Amphitheater in Veterans Park on Saturday, May 11th, 2013 from 3:00 - 7:00 pm. The five additional festival dates and locations are listed below and we encourage you to participate in as many festivals as you like.

Food Festival Participants will be divided into 4 different sections: **Food Producers, Restaurants, Organizations and Artisans.**

- We are recruiting **Food Producers** who are willing to set up a booth, interact with potential customers, give out small samples and directly sell fruits and vegetables, meats, cheeses, honey, flowers, herbs, value-added and artisan products to interested Festival goers. Producers in this section may also have products to sell as well as printed material for customers about locations where your products can be purchased.
- The second group of participants is **Restaurants** that use and serve locally produced food. For each Festival, our Festival Planning Committee will select one or two local **Restaurants** who will be invited to prepare and sell small sample plates ($3-$4 portions of entrées, sides, salads and desserts) that highlight Missouri-grown specialty crops. If you are interested, please contact us.
- **Organizations and Associations** with an interest in local food production, education and distribution will have the opportunity to sponsor a booth and hand out information about their activities and local Missouri-made products. They are also allowed to sell value added products represented by their association as well as handing out educational materials.
- Finally**, Artisans** who work in natural, agricultural materials are welcome to have a booth. Artisan vendor acceptance is subject to committee approval.

Festival Dates and Locations:

Callaway County	Veterans Park, Fulton, MO	Saturday, May 11, 2013	3:00PM – 7:00PM
Osage County	City Park, Linn, MO	Saturday, June 8, 2013	3:00PM – 7:00PM
Moniteau County	Downtown California, MO	Saturday, June 22, 2013	3:00PM – 7:00PM
Cole County	Jefferson City, MO	Saturday, August 24, 2013	4:00PM – 9:00PM
Boone County	Columbia, MO	Saturday, Sept. 7, 2013	4:00PM – 9:00PM
Cooper County	Boonville, MO	Saturday, October 5, 2013	3:00PM – 7:00PM

Booth Rental Information:

1. Booth spaces approximately 10' by 10' will be available. We will supply a set-up diagram one week before the festival.
2. You will need to provide your own set-up materials. (Table, tent, chairs and electric cord if electricity if needed).
3. Booth prices are as follows: *Booths are FREE for MRBA members (membership is $50).*
   - Producers /Artisans- $25 for each 10'X10' space.
   - Restaurants (invited to sell) - $50 (If you own a restaurant and want to sell food contact us soon.)
   - Organizations / Associations - $25 for each 10'X10' space.
4. Electric hookups are available for an additional $10 (if power is available).
5. All participants sampling or selling food must comply with each county's specific health department regulations. Basic Health Department information is below. Contact each county for specific details.

Who we are: The Missouri River Bluffs Association (MRBA) is a Missouri non-profit organization whose members include small retailers, artisans, food producers, and community members who are working together to promote local food, regional cuisine and heritage tourism in the five counties along the Missouri River in Mid-Missouri. The six Taste of Local Missouri Food Festivals are supported by a grant from the Missouri Department of Agriculture Specialty Crops Grant program to the Missouri River Bluffs Association. MRBA is working with the Missouri River Communities Network to coordinate and organize the Taste of Local Missouri Food Festivals. These Food Festivals are being co-sponsored by the Missouri Farmer's Market Association, the Missouri State Beekeepers Association, 4-H groups and the Missouri Local Food Production and Education AmeriCorps VISTA Project.

Health Department Permits/ Temporary Food Permits

Callaway County/Fulton, MO: If you are just selling produce then no permit is required. All food vendors who are giving samples of prepared food must have a Temporary Food Permit. They need to contact the Callaway County Health Department- Environmental Services at 573-642-5750 or go into the office at 4950 County Rd 304, Fulton, MO 65251 to obtain a permit. There is no fee required. **Permits need to be acquired ten days before the event. For Taste of Local Missouri, on May 11th, the permit application needs to be handed in by May 1st.**

Osage County/Linn, MO: No permit is required but all food handlers should follow state food safety guidelines.

Moniteau County/California, MO: No permit is required but all food handlers should follow state food safety guidelines.

Cole County/Jefferson City, MO: City of Jefferson Health Department: *for events held on city property.* All vendors who hand out food samples must have a City Temporary Food Permit and meet all guidelines for food safety. www.jeffcitymo.org (go to city services and scroll down to temporary food permits.) The cost is $25. Local restaurants serving food (and who already have food permits) do not need a special permit but the Health Department does need to be informed of their participation.

The Taste of Local Missouri

Food Festivals

Participant Application

Contact Name: _____

Organization name if applicable):_____

Address: _____

Phone number: _____

Email: _____

Website (if applicable): _____

Please check the Taste of Local Missouri Festivals that you would like to participate in:

☐	Callaway County	Veterans Park, Fulton, MO	Saturday, May 11, 2013
☐	Osage County	City Park, Linn, MO	Saturday, June 8, 2013
☐	Moniteau County	Downtown California, MO	Saturday, June 22, 2013
☐	Cole County	Jefferson City, MO	Saturday, August 24, 2013
☐	Boone County	Columbia, MO	Saturday, September 7, 2013
☐	Cooper County	Boonville, MO	Saturday, October 5, 2013

Are you a:

☐	Producer/Artisan	$25 per event per 10'X10' space
☐	Organization / Association-	$25 per event per 10'X10' space
☐	Restaurant selling small plates -	$50 per event (Contact us immediately)

Total number of festivals you plan to attend: _____

Number of Festivals _____ X # of spaces at each festival _____ = _____ Total Amount Due

Total amount enclosed: _____

Please make check out to: Missouri River Bluffs Association (MRBA)

Mail check and application to: Missouri River Bluffs Association; P.O. Box 7744; Columbia, MO 65202

Please contact us with any questions or concerns: Phone: (573)-256-2602

Email: tasteoflocalmissouri@gmail.com

Website: www.tasteoflocalmissouri.com

THEMES EMERGED FROM DEBRIEFING INTERVIEWS WITH FOOD FESTIVAL PARTICIPANTS

(And unsolicited Feedback from vendors & planning partners in the communities)

Callaway County – MRBA members have received inquiries about plans for future festivals and requests for assistance/information about how to manage and arrange a Food Festival

Moniteau County – At the Food Festival a local group began a conversation about the need for a Farmer's Market in the County. They now have a regular market operating in the county seat. Community member have also inquired of MRBA and MRCN members as to plans for holding a market in the county in the coming years.

Osage County – The local Farmer's Market reports increased sales beginning with the Food Festival. A Community Group – The Osage County Agritourism Council – in collaboration with local Government Officials has plans to hold a Food Festival annually, beginning in June 2014 (the plans for this festival are well underway). The Agritourism Council reports that interest in local produce has exploded since the festival there "…it's all the rage..." in the words of local council member. (Note: this Festival had the highest level of participation from local officials)

Cole County – The vendors at this Urban Festival reported excellent sales. The historic neighborhood association (this original neighborhood was the location of the MRBA/MRCN Festival) is discussing plans to hold similar events on a regular basis. The planning of this event introduced some producers to resources available in this area; as a result some producers are utilizing a certified Kitchen to prepare products for distribution and to teach others about specialty crop preparation.

Boone County – This urban festival was very well attended but vendors reported poor sales. As this community has two long standing Farmer's Markets with huge participation, the sense of the planners and participants was that attendees were already attuned to local produce. It was suggested that future Festivals be held in smaller towns in the County where access to local produce is more limited, etc.

Cooper County - There was a lot of interest and attendance at this festival, early in the day, however as it was held late in the year, by mid- afternoon it was quite damp and cold – the sense of the participants was that Festivals would be better held from May – September. The Festival here was held in a Park somewhat off from the "down town" area – several people reported having a bit of a problem finding the location.

All Festivals - The Children's Activities and Cooking/Preparation Demonstrations were very popular, as were unusual products (i.e. Veggie Popsicles). MRCN and MRBA both continue to receive inquires about organizing future festivals – the communities where they were held have all indicated interest in continued activity. Producers and vendors from outside the region have also inquired/requested information about food festivals – there is a clear sense that the festival effort furthered interest in and awareness of locally grown specialty crops, particular producers and vendors, and learning more both within the region and in surrounding areas.

MID MISSOURI FOOD PRODUCERS SURVEY

This survey of Food Producers in the Mid Missouri Area was conducted via Survey Monkey in the fall of 2013 and included both participants and non-participants in the Food Festivals. There were about 80 respondents. No statistical analyses were applied to the results but the descriptive results are below.

THEMES EMERGING FROM OPEN ENDED RESPONSES TO QUESTIONS ABOUT IMPEDIMENTS/SOLUTIONS/ NEXT STEPS (# mentions)

- *Educate* public about various aspects of local food (21 mentions)
- *Distribution* issues (19 mentions)
- Various *supply and access* issues – year round/location of markets (11 mentions)
- Various issued related to the impact/necessity?/alternatives to? - *competitive paradigms* – transparent complete pricing by all, issues of scale, business plans and regulation, competition for customers, educating vendors, community and institutional connections (10 mentions)
- *Processing* issues (5 mentions) *some comments counted in access/supply theme may have to do with processing?*

UTILIZATION OF FARMER'S MARKETS

- Over half of the respondents were associated with markets with over 80 vendors on average and which are usually crowded.
- About one quarter of the respondents were associated with markets varying from 20-50 vendors
- About one quarter of the respondents were associated with markets with fewer than 15 vendors
- The respondents from the smaller markets reported fewer customers in general and variability in the number of vendors

COOPERATIVE PROCESSING

- 73% of the respondents said it would be extremely likely that they would use such a service, 27% said maybe
- The reasons for not using such a service/opportunity were:
    - Do not need or want (80%)
    - Could not pay (20%)

CURRENT DISTRIBUTION OF SALES OF LOCAL FOODS

- 90% of sales occur at Farmer's markets
- 57% of respondents have some vendors selling to institutions in their county
- 54% of respondents have some sales to restaurants

50% OF THE RESPONDENTS WOULD *ABSOLUTELY* GROW MORE IF THE MARKETS FOR PRODUCE WERE AVAILABLE WITHIN THEIR REACH, 28% WOULD *PROBABLY* GROW MORE

REGIONAL ASSOCIATION SURVEY – IN PROGRESS

In Collaboration with the Division of Applied Social Science, College of Agriculture, Food, and Natural Resources at the University of Missouri – MRCN and three Regional Associations in the Missouri River Valley have developed and disseminated a survey to about 850 local businesses and advocates in the regions. The results of this survey (using Quadrics/SPSS programs) will be statistically analyzed. The survey is still open at this time; a preliminary report is anticipated to be available by mid-May 2014.

The purpose of this survey is to gather information from local businesses and from local enterprise advocates as to what regional resources and/or activities they would support *because* such would further the viability of their operations and the health of the regional socioeconomic system in general. Although the survey includes others the majority of the subjects are food producers and/vendors operating in the region.

A cursory and preliminary peek at the responses to date (about 10% thus far) seems to indicate a high degree of interest in and valuing of locally produced food - *and for both local and regional* ***events*** *that raise awareness of regional specialty crops and products.* Regional branding and promotion appears to be receiving high ranks thus far in the process.

This survey is constructed such that (given a sufficient response rate) the responses of specialty crop producers may be analyzed separately. Certainly the researchers hope to obtain a clearer sense of the *perceived utility of Food Festivals or similar promotion events* from advocates and participants in the localized/regional economic landscape.

This Summary of Survey Results and Feedback Information written and submitted by:
Nancy Holloway, (PhD Candidate in Rural Sociology at the University of Missouri-Columbia and Former US Public Health Service and Veteran's Administration Medical Services Social Worker). 4/10/2014

Project 3: SITES Education Project

Western Nursery and Landscape Association
Sarah Woody Bibens
Final Performance Report

Project Summary

In 2012, most Missouri growers of nursery plants were not yet able to meet the Sustainable Sites Initiative (SITES) requirements for sustainable plant production. SITES will be released in mid-2013 and landscape architects will design projects to these standards. Missouri-based landscape architects who work on SITES certified projects might have to work with out-of-state plant growers in order to meet certification requirements.

The Western Nursery & Landscape Association organized two days of education in January 2013. This education supported Missouri growers and provided them the tools

they need to meet SITES certification requirements for plant material. The sustainable plant production requirements include 8 select requirements

About SITES[1]: "The Sustainable Sites Initiative™ (SITES™) is an interdisciplinary effort by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at The University of Texas at Austin and the United States Botanic Garden to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices. The Sustainable Sites Initiative (SITES™) was created to promote sustainable land development and management practices that can apply to sites with and without buildings."

This education is particularly timely because SITES will be formally released to the marketplace in 2013. To date, only 3 pilot projects have received SITES certification, including the Novus Headquarters Campus project in St. Charles, MO. The number of certified projects is expected to increase significantly in the coming years. According to SITES, "The U.S. Green Building Council (USGBC), a stakeholder in the Initiative, anticipates incorporating these guidelines and performance benchmarks into future iterations of the LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™."

In addition, many Missouri growers are unfamiliar with the 8 requirements for sustainable plant production that are required by SITES. While a number of growers are likely close to meeting some or all of these practices (many have gained traction in the industry irrespective of SITES requirements), a better understanding of the requirements and intentions of the requirements will help growers market their product for SITES landscapes.

The motivation for the project was, quite simply, this lack of familiarity with the 8 requirements for sustainable plant production that are required by SITES. Informal discussions with industry stakeholders who have experience working on SITES projects repeatedly highlighted the difficulty in locating plant material from growers who meet the requirements. In addition, these discussions as well as informal discussions with Missouri growers reinforced that the requirements could be difficult to meet without educational resources to help provide direction and insight into the requirements. The project motivation was to help provide these educational resources and increase familiarity with the SITES requirements.

This project did not build on a previously funded project with the SCBGP or SCBGP-FB.

Goals & Outcomes Achieved

The educational event around which the grant activities were designed was planned and occurred. This included two days of education sessions on the details of the Sustainable Sites Initiative's requirements for sustainably grown plant production. In addition, a tour to Novus International, the first 3 star certified SITES project in the world was held. All logistics work was completed in preparation for the convention, including the audio/visual requirements, room set-up, pre-event marketing and on- site signage.

The following educational sessions were offered at the cost identified:

Sunday, Jan. 6 at America's Center in St. Louis

- 60 minute panel discussion on the business impact of SITES for

Missouri growers entitled “What does the future of SITES look like for growers?”

[1] According to USGBC there is “nearly 9 billion square feet of building space participating in the suite of rating systems (LEED) and 1.6 million feet certifying per day around the world.”

Panelists included:

- Moderator Jacob Blue, MS, RLA, ASLA, Applied Ecological Services and a member of the Vegetation Technical Subcommittee for the Sustainable Sites Initiative
- Lisa Storer, LEED AP, Program Coordinator with the Sustainable Sites Initiative
- Nick Kuhn, Community Forestry and Communications Coordinator with the Missouri Department of Conservation and a Technical Advisor for the Sustainable Sites Initiative
- Vic Jost, owner of Jost Greenhouses, one of the companies who grew plants for SITES pilot projects
- Dr. Michael Keyes, SCS Global Services, a national company who works to support sustainability with growers
- Carrie Coyne, landscape architect with SWT Design, the landscape architecture firm behind two of the SITES pilot projects in the St. Louis area

- 30 minute presentation on “Meet the SITES Requirement to ‘Use Sustainable Soil Amendments’”
  - Presenter: Roy Gross from St. Louis Composting, the company who worked with local growers and landscape architects to produce appropriate, sustainable soil media for SITES pilot projects

- 30 minute presentation on “Meet the SITES Requirement to ‘Reduce Runoff from Irrigation: Capture and recycle all irrigation runoff water on site’”
  - Presenter: Trish Beckjord with Midwest Groundcovers who is experienced with sustainable irrigation practices for greenhouse growers

- 30 minute presentation on “Meet the SITES Requirement to ‘Reduce Greenhouse Gas Emissions’”
  - Presenter: Susan Brown, Vice President of Business Development for Brightergy Solar
- 30 minute presentation on “Meet the SITES Requirement to ‘Reduce Energy Consumption’”
  - Presenter: Gary Steps, PMP, LEED AP with Butterfly Energy Works

Monday, January 7

- 30 minute presentation on “Meet the SITES Requirement to ‘Use Integrated Pest Management (IPM)’”
  - Presenter: Lloyd Travern, Peace Tree Farm and IPM practitioner

- 30 minute presentation on “Meet the SITES Requirement to ‘Reduce Use of Potable Water or Other Natural Surface or Subsurface Water Resources’”

    - Presenter: Trish Beckjord (also presented above for the “Reduce Runoff from Irrigation’ session)

- 30 minute presentation on “Meet the SITES requirement to ‘Reduce Waste’”
    - Presenter: Dr. Michael Keyes (also participated on the introductory panel listed above)

- 30 minute presentation on “Meet the SITES Requirement to ‘Recycle Organic Matter’”
    - Presenter: Dr. Michael Keyes (also participated on the introductory panel listed above and the ‘Reduce Waste’ session listed above)

- 60 minute tour at Novus International, the first 3 star certified SITES Pilot Project Tour led by:
    - Zach Snovelle, Landscape designer at SWT Design, the landscape architecture company behind the design at Novus International
    - Nickolas Krekeler, Project Manager at Landesign, LLC, the landscape maintenance company that maintains the Novus International site.
    - Jacob Blue and Dr. Michael Keyes also participated in the tour informally. While they did not help lead the tour, they were able to answer questions both about growing methods and the specifics of the SITES requirements.

Partner organizations assisted in the marketing of the event. Our partner organizations were GrowNative!, part of the Missouri Prairie Foundation, The Prairie Gateway Chapter of the American Society of Landscape Architects, and the St. Louis Chapter of the American Society of Landscape Architects. Each organization helped with digital marketing leading up to the event. In addition, advertising was purchased from the Missouri Landscape and Nursery Association

The grant centered on the two-day event in January 2013. Outcome measures have been achieved. The outcome goal was to plan and execute a two-day event in January 2013 that would include detailed discussions on each of the 8 points within the sustainable plant production category of SITES certification. The event schedule and speaker list is detailed above but individual sessions on all 8 points were offered in addition to an opening panel discussion and a tour of a St. Louis area SITES certified landscape. Appropriate speakers were retained for each session and together with our marketing partners, we completed our marketing and logistics goals. The logistics ran smoothly with audio/visual requirements, event space requirements and general event details.

The primary goal established for this grant was to organize and conduct two days of educational programming for Missouri growers that would systematically cover the requirements put forth by the SITES certification program for sustainable plant production. As covered above, detailed presentations were held during the course of the two-day event, covering each of the 8 requirements within the sustainable plant production aspect of SITES certification. In addition, a panel discussion and tour of a SITES project were held to provide a more solid overview of the benefits of meeting SITES requirements for sustainable plant production for Missouri growers.

Initial survey results prior to the education in January indicated Missouri growers were somewhat familiar about SITES but did not meet all the standards for sustainable plant production. Nor did

they know all of these standards. Following the education, attendees knew much more about the standards for sustainable plant production and how to meet these standards.

Pre-event survey results indicated that 50% of respondents had never heard of the SITES requirements for sustainable plant production and 50% knew there are requirements but were not sure how many requirements their company met. In addition, 50% of respondents indicated they wanted to find out more about SITES and decide if growing plant material to meet SITES requirements was 'worth pursuing' for their company. In addition, 100% of respondents were not currently growing plants that met SITES requirements.

More recent surveys of Missouri growers indicate that 50% are familiar with SITES and meet at least some of the requirements for growers. In addition, the most recent survey (done after the SITES education funded by this grant), 50% of those who responded are growing plant material for SITES projects. Additionally, around half of respondents, said that SITES projects were becoming more important to the horticulture industry and for Missouri growers.

Beneficiaries

Approximately forty-seven Missouri growers of horticultural product were the primary beneficiaries of this project. The growers in attendance received detailed information, insights and advice on how to meet the 8 requirements set forth in the sustainable plant production aspect of the Sustainable Sites Initiative certification.

Lessons Learned

The primary learning experience was largely the effect of the shorter than anticipated turnaround time to produce the educational event. We did not receive formal notification of the grant approval until mid-November. The event was January 6 & 7. This quicker than anticipated turn-around affected our ability to adequately market the event (our marketing was essentially compressed into 4 weeks rather than the usual 3-4 months of marketing for an event). In addition, finalizing and booking speakers with only 6 weeks of lead-time during the holiday season proved a challenge. We were able to retain excellent speakers who are very knowledgeable in their industry but we were not able to do the types of pre-event marketing and promotion that is typical. Often we try to promote an event with articles and information from speakers and encourage our speakers to help promote the event as well – this quick timeframe meant this type of more in-depth marketing was nearly impossible. Outside of these unexpected marketing challenges, the event came together reasonably well and ran smoothly.

We are not aware of any unexpected outcomes or results.

We had initially hoped for a stronger turn out. The education was offered free to Missouri growers. Missouri growers were even given free registration to all of the National Green Centre conference and trade show (the larger horticulture industry event at which this education was held). The very quick turnaround time hurt us a bit. We didn't receive formal notification of the event until mid-November. The event was Jan. 6 & 7.

This really forced us to condense our marketing plan – especially the marketing and support that partner organizations were able to provide. Consequently, we did not have time for an

educational marketing campaign in which we explained more thoroughly why Missouri growers ought to care about this education, why SITES is important, and what the growth projects are for SITES. In our quest to plan an education track in such a condensed amount of time, our and our partners' marketing efforts assumed Missouri growers were more familiar with SITES than they actually were. We assumed they understood SITES in a general sense and that the education would provide more detailed knowledge. An educational campaign leading up to the event would have helped on-site attendance.

I do not have exact figures from each individual SITES session but the conference itself attracted 508 attendees and 423 exhibitors. Some of the larger Missouri growers are represented in the exhibitor figure. Many growers attend the conference and do not exhibit, however, so would be counted in the attendee figure. Attendees at the conference are not exclusively growers but are all horticulture industry professionals. Approximately 2/3 of the attendees were from the state of Missouri.

Contact Person

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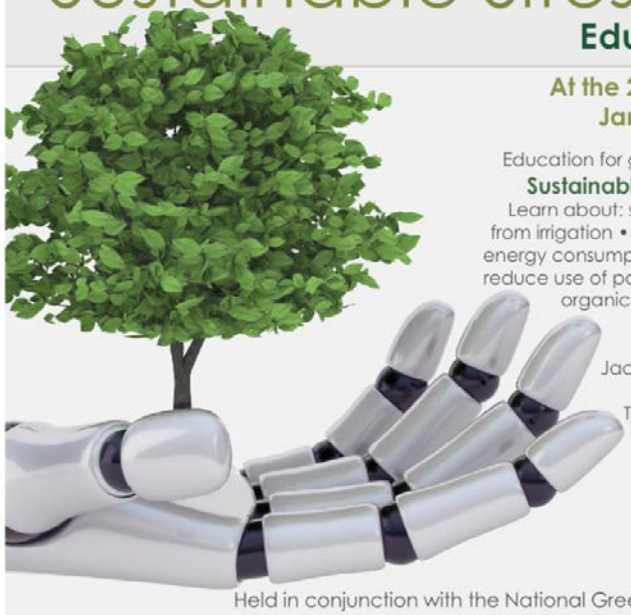
Additional Information

Marketing Postcards:

Sustainable Sites Initiative

Education for Growers



At the 2013 National Green Centre
Jan. 6 & 7, 2013 • St. Louis, MO

Education for growers to meet the requirements for
Sustainable Practices in Plant Production
Learn about: sustainable soil amendments • runoff from irrigation • renewable energy sources • reduce energy consumption • integrated pest management reduce use of potable water • reduce waste recycle organic matter • discussion on future of SITES

Speakers include: Lisa Storer, SITES
Jacob Blue, Applied Ecological Services
Michael Keyes, SCS Global Services
Trish Beckjord, Midwest Groundcovers
Lloyd Travern, Peace Tree Farm
Gary Steps, Butterfly Energy Works
Susan Brown, Brightergy
Roy Gross, St. Louis Composting

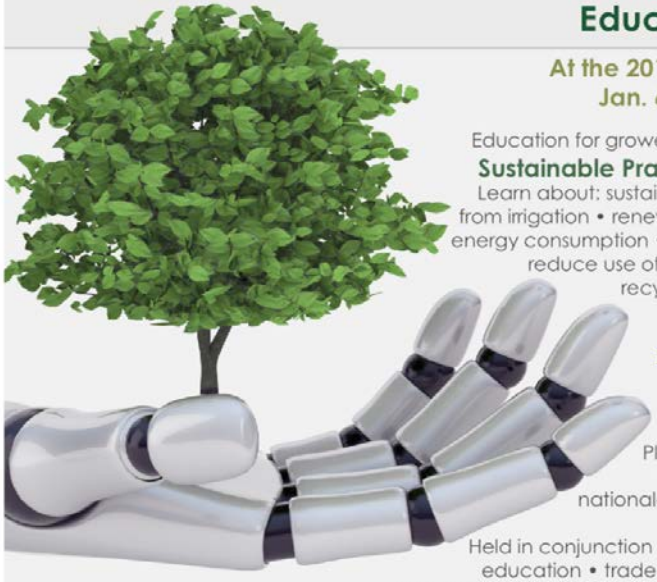
FREE for Missouri Growers!

Held in conjunction with the National Green Centre education • trade show new plant fashion show • (additional registration required for National Green Centre)

More information: www.nationalgreencentre.org • 888-233-1876

Sustainable Sites Initiative

Education for Growers



At the 2013 National Green Centre
Jan. 6 & 7, 2013 • St. Louis, MO

Education for growers to meet the requirements for
Sustainable Practices in Plant Production
Learn about: sustainable soil amendments • runoff from irrigation • renewable energy sources • reduce energy consumption • integrated pest management reduce use of potable water • reduce waste recycle organic matter • discussion on future of SITES for growers

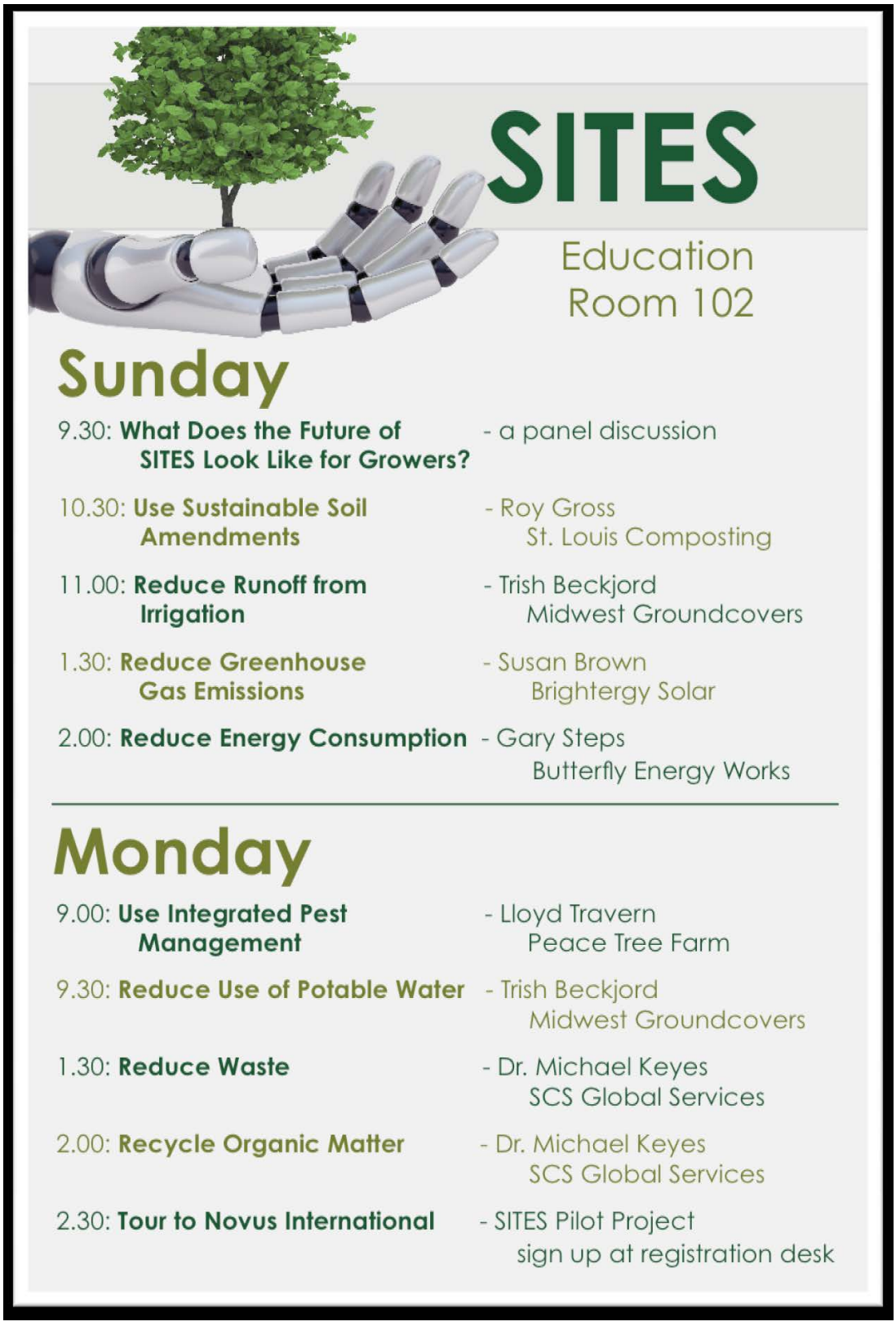
FREE for Missouri Growers!
5+ hours education and tour!

Survey
Please help us with complete the grant by completing this survey
nationalgreencentre.org/survey.vp.html

Held in conjunction with the National Green Centre education • trade show • new plant fashion show (additional registration required for National Green Centre)

More information: www.nationalgreencentre.org • 888-233-1876

Onsite Signage:



Project 4: City Seeds

Gateway Greening, Inc.
Andrea Mayrose
Final Performance Report

Project Summary

Gateway Greening proposed to enhance the learning environment at its specialty crop educational and employment program, City Seeds Urban Farm (CSUF). The number of producers of specialty crops in the St. Louis region has not kept up with the sharp rise in farmers markets seeking vendors, nor the increased demand for locally grown fresh food by consumers. However, there is no shortage in people *wanting to learn* how to grow specialty crops.

For 30 years, Gateway Greening (GGI) has provided educational programs encouraging neighborhood groups and youth to learn more about how to grow vegetables by incorporating hands-on learning in over 240 community and schoolyard gardens. Teachers link these lessons into the daily routine of more than 90 schools and outdoor classrooms. Building on this tradition, Gateway Greening continues to train up to 100 adults a year how to grow, tend and market crops at City Seeds Urban Farm. GGI educates these 100 clients, hundreds of volunteers, tour groups, school groups and the general public on the importance of growing and consuming specialty crops by conducting on-site tours and coordinating volunteer opportunities at the Farm. In addition, nutrition literacy is tied to the consumption of specialty crops, particularly in low-income communities with cooking demonstrations and nutrition workshops. Food grown is sold at local farmers markets and distributed to non-profits serving low-income families including Food Outreach and Operation Food Search. Volunteer assistance and leadership is provided by University Extension Service St. Louis Master Gardeners.

The project was also timely due to the current economic climate. People in the lowest rung of the employment ladder are often the last to find work. The City Seeds Employment training program has consistently seen placement rates of 70-80%.

This project built on a previous funded Specialty Crop Block Grant by improving the learning environment at CSUF by adding a shade structure over an outdoor classroom. It also improved vegetable seedling production and provided high quality training to adults on specialty crop production.

Project Approach

The objectives of this project were to teach urban agriculture and horticulture skills to St. Patrick Center (SPC) clients. SPC is a non-profit serving homeless, ex-offenders, unemployed veterans and dually diagnosed individuals with mental illness and substance abuse. This project focused on safe food production in an urban environment; seedling development and season extension techniques, pest and disease management; harvest techniques, packaging and preserving crops for sale; customer service skills; and how to conduct a successful farm stand. In addition, on-going nutrition education is covered. In 2013, this project also heavily focused on specialty crop seedling distribution and improving the training curriculum at the City Seeds Urban Farm.

In the 2013 grant period, the job training curriculum was heavily revised and improved to include a color notes section for participants, a new unit on leadership and teamwork, and updates to each section. Approximately 20 large, educational signs were designed. These were to be installed on site to further educate clients and visitors on topics like composting, beneficial insects, vegetable crops and soil. Unfortunately, printing and installation of educational signage was postponed until a permanent site is located. During the growing season, activities included daily instruction at City Seeds Urban Farm (CSUF) with formal classes, hands-on demonstrations and field work. Guest speakers contributed monthly cooking and nutrition demonstrations and employer-led topics like irrigation and hardscape. Weekly training at the farmer's market gave clients customer service and retail skills. Monthly field trips to Gateway Greening's hoop houses, the Missouri Botanical Garden, and places like Operation Food Search provided insight into the bigger picture on food production and distribution throughout St. Louis. Propagation demonstrations at the GGI hoop houses, contributed to thousands of vegetable seedlings distributed to community and youth gardens. Individual, group volunteers and tours at City Seeds Urban Farm provided on-going education and outreach efforts to raise awareness about the importance of specialty crops and insights into the local food system.

In this reporting period, nine educational food demos have occurred, educating clients on nutrition and fresh food preparation of specialty crops. Operation Food Search and chefs from Lumiere and River City Casinos have taught cooking, knife skills and recipes including roasted vegetable hummus, fresh peach slump, white bean, vegetable & sausage ragout, Parmesan kale and more. These activities offer clients a taste of the harvest with communal meals like Indian tacos, grilled asparagus, citrus beet green & kale salad and crispy tilapia.

Information was disseminated to the public through Gateway Greening's weekly e-newsletter, with a special section on City Seeds Urban Farm updates. Facebook and Twitter updates occur daily, and the website is revised twice a week to post upcoming events and educational opportunities. The newsletter is released quarterly via print and on-line. In this calendar year, 4,160 total volunteer hours have been served at CSUF informing thousands on the importance of specialty crops, urban agriculture and providing an introduction on production. Thirty-six school field trips, public tours and presentations have also consistently educated the public on these topics.

Program graduations were especially touching. Whether the accomplishments were recognized from the 10-week job-training graduates or 15-week therapeutic horticulture group – each and every occasion was marked with touching remarks and testimonials by participants. Significant program results include life and job skills, increased self-confidence, sobriety, sound mental health and self-sufficiency for over 450 clients, since the farm was established in 2006. Since then, 70,000 pounds of local, affordable, organic high quality produce has been distributed. Challenges and sudden changes have consisted of the transitional nature of this population, staff turnover, and changes in funding.

This project is extensive in project partners and collaboration. St. Patrick Center provides screening for client selection in the program and is responsible for providing the soft skills necessary for successful employment. Operation Food Search offers nutrition training with its cooking classes. Gateway Greening provides the horticultural training and directs the running of the City Seeds Urban Farm. Food Outreach provides nutritional support to individuals dealing with HIV/AIDS and cancer. They purchase and distribute produce from City Seeds Urban Farm. St. Patrick Center and Gateway Greening work with leaders in the green industry to educate employers on the benefits of hiring graduates. GGI networks with area businesses to provide appropriate learning and technical experiences for participants. Horstmann Brothers

Landscaping is an area employer that has provided hardscape, irrigation and mowing training and has hired multiple graduates.

Goals & Outcomes Achieved

The activities described above include daily teaching and instruction at CSUF, formal classes off-site, hands-on demonstrations and fieldwork. Field trips, guest speakers, cooking demonstrations, and work at a farmer's market were all aspects included in the training curriculums. Therapeutic horticulture clients also participated in the production of value-added products including herb vinegars, honey and lip balm. Commercial mowing, OSHA training (Occupational Safety and Health Administration), and work experiences at Forest Park Forever offer a diverse learning experience. Progress is tracked on client performance through daily attendance, weekly homework and reading assignments, field competencies, behavioral evaluations, pre & posttests, surveys, assessments and informal feedback. To track farm production, harvest weights were recorded, sales, donations and the distribution breakdown to compare each year.

This grant enhanced the quality of the training program and distribution and education efforts on specialty crops. New hoop house supplies improved the quality of seedlings available to all GGI programs. A new fertigation system and improved pH schedule was followed, which increased overall growth. Further contributions included new sanitation supplies and additional venting. Also, the bench warming system, which heated plant roots, meant the plants germinated several days quicker, creating healthier plants overall. Improved seedling quality directly impacted CSUF in particular, which produced record yields – 14,000 lbs. of specialty crops in 2013. The 2013 harvest was almost 5,000 lbs. higher than 2012.

The shade structure installed over the outdoor classroom improved the learning environment for participants and the general public, through tours, events and field trip activities. Extreme heat, sun and inclement weather no longer impeded daily class topics and provided a mental break from on-going physical work in the field. Installation of the educational signage was postponed until CSUF is relocated to a permanent site, in light of future redevelopment in the area. In 2013, 85 clients participated in the therapeutic and job training programs. New events and on-site activities (like cooking demos and festivals) showcased the importance of specialty crops to hundreds of SPC clients, volunteers and visitors. In 2013, a total of 36 tours, field trips and outreach activities informed over 750 people about specialty crop production. Over 4000 individual and group volunteer service hours were dedicated at CSUF, further spreading the message of food security and urban agriculture across the St. Louis region.

Gateway Greening has successfully enhanced the learning environment for program participants. This is further demonstrated by over 80% of job training graduates being successfully placed in employment and 100% of program graduates improving on their post-test scores. Please note the following data on the 2013 therapeutic horticulture participants:

- 79% of participants reported maintaining or increasing the amount of fruit or vegetables they eat daily.
- 93% of participants reported maintaining or increasing their sense of self-confidence
- 57% of participants reported maintaining or increasing their sense of happiness
- 71% of participants reported maintaining or increasing their ability to cope with stress

- 93% of participants demonstrated maintaining or improving in their general horticulture knowledge.
- 86% of participants reported remaining free from using illegal or non-prescription drugs (i.e. marijuana, crack/cocaine, speed, methamphetamines, heroin, or non-prescription opiates).
- 86% of participants did not increase the amount of alcoholic drinks that they would consume on a single occasion

Beneficiaries

Beneficiaries to this project are many and diverse. St. Patrick Center clientele benefitting from CSUF include individuals dealing with unemployment, homelessness, substance abuse, mental illness and recent prison release. During this grant period 85 St. Patrick Center clients were served. In 2013 over 7,000 lbs. of produce have directly benefitted thousands of the food-insecure clients dealing with HIV/AIDS and cancer through Food Outreach. CSUF donated 3,600 lbs. of specialty crops to food banks, transitional housing facilities and shelters in 2013. In this same time period 4,160 total volunteer hours have been served at CSUF informing thousands on the importance of specialty crops, urban agriculture and providing an introduction on production. Thirty-six school field trips, public tours and presentations have also consistently educated the public on these topics.

In this grant period, $ 16,687 in produce sales has occurred, directly impacting the program and the economy. Farmer's market and wholesale sales have benefitted client stipends, supply purchases, utilities, plant material, etc. The skills that are learned by clients are limitless in their potential economic impact; they can supplement their lifetime food budget with food they can grow themselves. Clients will have the knowledge to produce and sell specialty crops to the public. With the additional job skills they will obtain from the program, once employed, they will have more available funds to support a well-rounded diet. Once trained, clients can move out of the non-profit realm and into income generating positions that will take them off of public assistance and into the realm of self-sufficiency, able to perform knowledgeably, farm tasks in for-profit enterprises.

Lessons Learned

CSUF continues to successfully train clients on specialty crop production while distributing affordable, local, organic produce. In this one-year grant period, program activities continued on track but new lessons were learned. The installation of the shade structure was challenging due to the poor communication and follow-through of the contractor. The installer had to return to the site to add additional anchors. However, this structure has not only benefitted daily classes and visitors, but has also contributed a new curing space for potatoes, onions and winter squash. This was an unintended benefit, but much needed. The improvements in hoop house management have resulted in stronger, high quality seedlings distributed to 134 community and school gardens. These seedlings produced an estimated 8,706 lbs. of specialty crops. The hoop houses served as the location for 7 field trips in 2013. GGI will continue to improve the CSUF program by focusing on changes with client tracking, distribution, funding and community outreach. The transient nature of the St. Patrick Center population makes tracking long-term outcomes especially difficult. Likewise, reliance on partners for consistently tracking and communicating relevant program data can be challenging. Moving forward, St. Patrick Center is

going to streamline reporting for 18-20 case managers and include additional outcomes, like housing. Gateway Greening has designed an independent client intake system that may work towards taking over this program aspect and job placement in the long term.

To improve program financial sustainability, Gateway Greening will also focus on developing employer sponsorships and alternative funding sources. CSUF market sales will be relocated to Bell Garden (GGI's outdoor office and St. Louis' largest community garden) for 2014 and beyond. This will unite farm programming with GGI's community, youth gardens and civic greening components. Bell Garden sales will also provide more direct community impact. GGI is also working at increasing and consolidating wholesale produce sales, acting as a potential food distributor for community garden production through Bell. Gateway Greening reaches out to hundreds of individuals through tours and presentations, in order to better capture these numbers – CSUF staff will get information sheets from each attendant starting in 2014. An additional lesson learned is the importance of a permanent site. Recent development changes in St. Louis will affect the CSUF site. GGI is working with community leaders and partners to find a larger, permanent home for the farm programming so we may continue to educate our community on the importance of growing and distributing specialty crops. Therefore, grant funds were not used to add approximately 20 educational signs at CSUF. This project will be postponed until a permanent site is secured. These funds were approved and redirected towards client stipends in light of a loss of federal funding due to the government sequester. A total of $ 305 was spent on project banners/signs, thus the remaining $ 2,250 was approved by the Missouri Department of Agriculture to be reallocated to help cover client stipends for program participants.

Client stipends are provided for job training participants at the rate of $75 dollars/week. Therapeutic clients receive $30/week. Stipends are essential to provide incentives, accountability and help offset the cost of program travel to the farm, classroom and multiple field trips. Both programs are part-time, so clients can continue to work, attend meetings, and fulfill case management expectations. However, the stipend helps participants afford to participate in a training program while they are building the necessary skills to be successful in full-time employment. Clients sign in each day; these attendance and time sheets are collected and tracked by St. Patrick Center. Every week, St. Patrick Center processes and distributes the checks to program participants. If clients are absent, their check is directly affected. The amount spent on stipends occurred in only this reporting period for the participants involved directly in this grant. There is no future or retroactive impact on stipends, as the Specialty Crop project is complete.

Contact Person

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Additional Information

Gateway Greening website www.gatewaygreening.org

Project 5: SLU Gardens to Tables Teaching Orchard

St. Louis University
Mildred Mattfeldt-Beman
Final Performance Report

Project Summary

The Department of Nutrition and Dietetics at Saint Louis University provides education to local schools and community organizations in gardening and nutrition and hosts a summer garden/culinary camp for area children. An orchard expands the education experiences of students and would provide fruit to Fresh Gatherings café, the student café operated by the Department, as well as the surrounding community through our CSA Fresh Harvest, with excess provided to community outreach programs, such as Campus Kitchen. It is the intent that this be a teaching orchard, hosting education programs targeted initially to those who would like to add fruit trees to their school gardens and to community members who would like to add a fruit tree(s) to their yard. As a secondary purpose, we wanted to expand the research in edible crops on campus and partnered with the Department of Biology to include pecans and grapes in the orchard design. The primary purpose of this project was to establish a teaching orchard with emphasis on organic growing techniques that will enhance the competitiveness of specialty crops and benefit the specialty crop industry. A secondary purpose was to enhance the curriculum in sustainable food systems through collaborative research with the Department of Biology. The orchard would be built around the concept of permaculture – a self-sustaining landscape. Emphasis was placed on companion plants for natural soil enhancement and pest control, lowering the amount of maintenance, and encouraging others to add fruit trees to the community landscape. Adding an orchard to the current Gardens to Tables Farm combined the concepts of urban farm, orchard, and community outreach to further efforts towards hands-on experience in building a sustainable food system.

The SLU Gardens to Tables Teaching Orchard Project established an urban orchard on the University campus for purposes of educating students, teachers and the community on the skills needed to establish and maintain an orchard, with emphasis on organic growing techniques and principles of permaculture. The project has successfully established the orchard with 44 fruit trees, over 30 berry bushes, 3 pecan trees and 5 hazelnuts. Vineyard sites for edible grapes have been established – both with high cordon and pergola structure to demonstrate various ways they can be incorporated into an urban environment. With this teaching resource, students in both Nutrition and Dietetics and Biology have been actively engaged in curricular activities that use the orchard as a living classroom and research environment. The Sustainable Food Systems course includes class research projects in specialty crops and experiences in planning and executing training permaculture and pollination. The orchard is also incorporated into the annual culinary camp activities and reaches approximately 150 community children and their families annually. Community outreach has provided training in planting, pruning, and permaculture to community members and area teachers. The department continues to build the website resources for the orchard.

This was an initial grant and did not have any previously funded project with the SCBGP or SCBGB-FB.

Project Approach

The primary purpose of this project was to establish a **teaching** orchard with emphasis on organic growing techniques. Annual orchard training workshops and discussions with community members, teachers, and students were held. A secondary purpose was to enhance the curriculum in sustainable food systems through collaborative research with the Department of Biology. The orchard was built around the concept of permaculture – a self-sustaining landscape. Adding the orchard to the Gardens to Tables Farm combined the concepts of urban farm, orchard, and community outreach.

1. Establish an Urban Orchard: This project turned an un-used city block into a teaching orchard –a 'food forest'. Initial work began with testing of five urban city blocks owned by the University for contaminants. Three of the lots had high levels of lead, arsenic, nickel and/or cadmium and not suitable for food production. The Department initiated a sunflower program to remediate arsenic from one of the contaminated lots.

A study of the soil microbial profile was conducted on the selected orchard site to identify the presence of beneficial and/or pathogenic microbes in order to tailor interventions to promote optimum microbial soil profiles. The Audubon Society was engaged and provided feedback on how to increase native plantings in the orchard (nuts in particular) and to make recommendations on how to optimize pollinators with native habitat. Orchard plans were developed and reviewed with assistance from Stark Bro's Nurseries & Orchards Co., a horticultural company based in Louisiana, MO, established in 1889, specializing and growing fruit trees. Emphasis was placed on companion plants for natural soil enhancement and pest control, lowering the amount of maintenance, and encouraging others to add fruit trees to the community landscape.

Through collaborations with the University/city/department composting programs a remediation program for mulch and compost was established. By November 2014, fruit trees (44), pecans (3), blueberries (18), hazelnuts (6), elderberries (4), and chokeberry (2) bushes were planted and pruned. Later the following were selected to in fill in the rows: cherries (1); blueberries (4); and honey berries (2).

By 2015, the construction of high cordons for the table grapes project was completed. Following recommendations from the Biology Department, 16 table grapes were planted and used in planting and pruning workshops – including instruction on construction of cordons.

We were able to secure a VISTA for the orchard training/education activities.

2. Incorporate orchard – fruit trees, nuts, and grapes into the curriculum of SLU departments of Biology and Nutrition Dietetics: The Department of Nutrition and Dietetics has incorporated experiences with orchard permaculture and research projects engaging both graduate and undergraduate students with specialty crops issues in DIET 3030/5030 Sustainable Food Systems. In addition, a one week (40 hour) rotation in DIET 5940 Dietetic Internship (34 graduate interns) has been added and includes research in sustainable agriculture/permaculture as well as education activities with the children/families in the culinary camp. Many of these interns go on to work in schools and community outreach programs. Increasing their experience with fruit trees increases the probability that they will recommend that fruit trees be added to school and community garden plans. Interns are required to blog about their experiences and lesson plans developed for the classrooms; two of these blogs are available at: http://www.slu.edu/nutrition-and-dietetics/get-sustainable

Through these courses and outreach, the students established a scouting/monitoring program for common orchard pests. The topics being explored through these student initiatives continues to expand.

Creating research opportunities for faculty and staff in sustainable foods as well as increasing access to fresh fruits to the community are additional impacts. By the second year, there were 4 graduate Nutrition and Dietetic research projects in the teaching Orchard – including topics in wellness, bee habitat, permaculture design, and use of vermiculture castings.

The orchard/farm collaborated with the Department of Biology to create experimental studies in sustainable growing of food crops and strengthening our understanding of the role of pollinators. The Biology Department continues to generating a list of pollinators found in the garden (included endangered native bees). Both graduate and undergraduate students have had projects in the garden. Based on the experiences in the garden, Dr. Damon Hall and Dr. Gerardo Camilo initiated a research project – Social and Ecological Drivers of Pollinator Health. The project involves developing an interdisciplinary approach for examining relationships between pollinator health and urban land-use decision making in St. Louis and other cities.

The Engineering department has had meetings with the department to look at establishing a research program using a visible to shortwave infrared hyperspectral imaging system to generate knowledge on crop's phonological and physiological responses to water and ozone stress.

3. Education programs for teachers. Annually host a teachers training program to cover topics such as how to plant, pruning, pest management, harvest, storage, cooking, and nutritional value of fruit. Special emphasis will be placed on how to incorporate fruit trees into the curriculum: The Department works directly with seven inner city schools – each with a garden. This project has impacted our ability to help these schools add fruit trees to their gardens. Through these schools, we reach over 1,000 inner city students – the vast majority are low- income (50-98% receive free or reduced school lunch) and predominately African American. With several community partners, we have hosted or participated in training programs in gardening/orchard for teachers and community members. There have been from 35 to over 100 teachers in attendance. Materials developed for this project have been made available at: http://www.slu.edu/nutrition-and-dietetics/get-sustainable/gardens-to-tables

The orchard project was spotlighted at the Missouri Botanical Garden Foodology conference. This conference is designed for area teachers engaged in school garden programs.

4. Education program for the community. Host at least one outreach program for the public, most likely in coordination with our National Food Day activities with the educational program targeted to fruit trees: Our summer garden/culinary camp includes over 300 children and their parents annually. The weekly activities in the teaching orchard has Increased their experiences with fruit trees and the potential for planting trees in their home landscapes (http://www.slu.edu/nutrition-and-dietetics/gardens-to-tables-culinary-camp-2016). The camp includes daily education sessions and these have included planting, harvesting, IPM, and preparing fruits and vegetables from the farm. See examples at: http://www.slu.edu/nutrition-and-dietetics/get-sustainable/orchard-training

Orchard training was incorporated into the annual National Food Day program in the orchard – nearly 200 attend each year.

Multiple training programs for the community have been held secondary to the Teaching Orchard project including: Training with Elmer Kidd, Stark Bros Nursery's Chief Production Officer, on the topic of fruit tree planting, pruning and training fruit trees. Co-sponsored with EarthDance a Permaculture a workshop with Mark Shepard, with particular emphasis was on water management. The PI presented the teaching orchard project at a local food systems workshop at the Kress Farm Garden Preserve in Hillsboro MO. We were able to establish the SLU Community Gardens and provided education programing to this group annually on various specialty crop issues. We were able to engage with the local Girl Scouts – providing an orchard tour and education program including cooking demonstrations.

During the summer we hosted a Garden Market in the garden – selling produce from the garden and the orchard. This included nutrition educations. With community partners, we hosted 2 workshops on 'Preserving the Harvest' – hot bath canning of fruits/vegetables.

During the final year of this project, we were able to establish a summer internship program. Area youth can apply to the program to learn about permaculture and orchard maintenance. Lessons also include training with other specialty crops – primarily herbs and vegetables.

Secondary to work on this project as well as other garden endeavors, the department was invited to work with the Green House Venture Committee to establish a regional model of hands-on education and nutrition outreach. This project would help schools and teachers shape their pedagogy and offer classes at the schools. Faculty and graduate assistants from the Department of Nutrition and Dietetics will assist teachers in the science growing food and make available supportive materials and teaching ideas.

5. Compile educational materials - develop and make manuals available via the web for training teachers and lesson plans for incorporating fruit into a school garden: Educational materials, including lesson plans have been made available on our website.

6. Create webpage portal - develop a web page portal to share manuals, blogs, and lesson plans: Orchard training materials can be found at: http://www.slu.edu/nutrition-and-dietetics/get-sustainable/orchard-training Also established a Youtube channel - https://www.youtube.com/channel/UCSmvyv-LhVpP7W62aRUNfNg

7. Build urban agriculture collaboration: During this grant period we were able to establish urban agriculture partnerships. The initial partner was **Stark Bros Nurseries and Orchards** – they provided consultation and education programs as well as educational materials. Another early partnership to develop was with **Mission: St. Louis** which resulted in the VISTA Sustainability Committee. This committee brought together the area VISTA's to share their experiences in urban agriculture and to provide training in areas they had identified. Each meeting of the committee included some type of agriculture training.

The department has long been a collaborator with **EarthDance** (an organic farm school), **International Institute Global Farms** (a program to help new Americans provide fresh, healthy food to their families) and **Gateway Greening** (a program that educates and empowers through gardening and urban agriculture). We collaborated with International Institute and Gateway Greening to map community gardens, including orchards. We also provided training to the gardeners from these programs. We collaborated with EarthDance to provide training in permaculture. We have engaged the culinary camp with all these programs in tours and education programs at their facilities. Another long-time partner is the **East Side Health District** in East St. Louis. East Side has established an urban garden next to their clinic. We

provided assistance with planning their orchard and provided education programs to their clients.

We were able to bring together all these partners in training programs with national figures – Mark Shepard presented a program on permaculture with emphasis on water conservation and Elmer Kidd presented two programs on pruning, planting and caring for fruit trees.

Mildred Mattfeldt-Beman and Marjorie Sawicki, faculty in Nutrition and Dietetics, completed the 'Growing a New Generation of Illinois Fruit and Vegetable Farmers' one year training program – University of Illinois Extension (NIFA funded) – and established contacts with various local farmers and educators for future assistance.

Goals and Outcomes Achieved

All of the goals for this project were met with the exception of an inability to track 'hits' to the web page materials. An urban teaching orchard has been established with 20 Blueberry bushes, 8 apple trees, 4 cherry trees, 8 peach trees, 8 apricot trees, 8 plums, 2 pear trees, 3 pecan trees, 16 edible grape vines, and 2 honey berries.

The orchard has been fully integrated into the curriculums of the SLU departments of Biology and Nutrition Dietetics for both undergraduate and graduate students. As there was no integration at baseline, this easily **exceeded the 150% target**. Over 200 dietetic students and 30 biology students, both undergraduate and graduate, have engaged over the course of the project. Evaluation of the hands-on activities and grades in these courses indicated that **more than 75% of students (100%) demonstrated proficiency in the course competencies.** Results of the biology students' study of pollinators in the garden were presented at the Sustainability Conference at Webster University April 10-11, 2014 and faculty have initiated a research project – Social and Ecological Drivers of Pollinator Health.

Secondary to this project, the Department of Nutrition and Dietetics established a permaculture summer internship – 2 students have received training.

Annually, SLU hosted a teachers training program to cover topics such as how to plant, pruning, pest management, harvest, storage, cooking, and nutritional value of fruit. Special emphasis will be placed on how to incorporate fruit trees into the curriculum. In addition, the SLU project was a key note at the Missouri Botanical Garden Foodology conference for school garden programs with teams of teachers from area schools. Over **100 teachers** have received instruction. We also provided a tour of the orchard and education program to the Missouri Agribusiness Academy – **30** high school sophomores and their teachers (**3**). As we had not previously held training sessions specific to teachers, this was a significant increase. All the education sessions included teachers demonstrating their skills and/or sharing plans for their school gardens – **the goal of 80% of teachers demonstrating proficiency was exceeded.**

Outreach to the community has been very successful. Prior to this grant our only event for the community was the Food Day event. By the end of the grant period we had hosted booth and training session at each Food Day event – **150 to 200** at each of the events; held training sessions with SLO Food and VISTA, including lessons on fruit preservation – **35 in attendance;** incorporated orchard and specialty crop activities into the culinary camp weekly with over **600 s**tudents and their parents; hosted a tree planting workshop with Stark Bros Nursery and planted over 30 trees and scrubs - **17 trainees** received hands-on training; co-sponsored with

EarthDance a Permaculture Workshop with Mark Shepard - **135 were in attendance;** provided numerous garden tours hosted for community groups i.e. Girl Scouts, Sweet Potato Project, MBOT high school program; established the VISTA Sustainability Committee – **23** VISTA's received educational programs on the importance of urban orchards and purpose of permaculture – all assisted with orchard maintenance. Co-hosted the St. Louis Food Challenge – **20 community** members in attendance; hosted a tour and education session for the St. Louis Culinary Club – **23 in attendance.** Participants at the workshops were able to repeat the skills until proficiency was confirmed by Elmer Kidd or the instructor during the workshops on planting and pruning and at the garden lessons; **more than 70% (100%) demonstrated proficiency. The only workshop that did not include demonstration of skills was the Permaculture Workshop with Mark Shepard – this was information only.**

*The number of programs and attendance **easily exceeded the 25% increase goal**. All program evaluations rated the training highly, particularly the hands-on practice components.*

Educational materials were developed and made available via the web for training teachers and lesson plans for incorporating fruit into a school garden. Manuals - *Orchard training materials can be found at* http://www.slu.edu/nutrition-and-dietetics/get-sustainable/orchard-training

It is unclear if this goal was met as we were unable to differentiate hits for the training materials secondary to how program was linked and changes made to the University content management system (CMS) have caused previously available materials to no longer link. The University is going to a new CMS and we have been working with them to ensure these links are viable.

Created a web page portal 'Get Sustainable' to share educational materials, blogs, and lesson plans: http://www.slu.edu/nutrition-and-dietetics/get-sustainable

Webpage is schedule for rebuild May2016 with new CMS. Has been delayed twice and much of the materials posted were lost – including projects on permaculture and IPM. We have reloaded these items and will monitor when the new platform for the University is established. We have been unable to track the number of hits to the webpage and therefore are **unable to determine progress** towards this goal.

We were able to build an urban agriculture coalition that continues to inform the project. The collaboration includes Stark Bros Nurseries and Orchards, the Biology Department, **the International Institute Global Farms**, EarthDance Farm, **4 School Districts**, Mission: St. Louis (formerly SGSM Americorps VISTA), **Sweet Potato Project**, **Mid-Town Mommas**, **Old North Farmers Market**, **HOSCO Foods** and numerous local farmers. This represents more than a **>100% increase** from the initial benchmark of 4.

Beneficiaries

A large number of individuals benefited from the project: **1,126 ++ (does not include web)**

The community benefited from the project by the presence of a beautiful urban orchard in their neighborhood. They also received hands on training; development of more meaningful 'classroom' experiences; better understanding of possible roles of urban orchards; increased skills in care of orchard and use of orchard produce; greater understanding of what is needed to produce the food they consume; how to prepare soil for planting; the benefits of permaculture

and complementary plantings; and how to prune fruit trees for better growth and fruit yield. The community may benefit in the future from having professionals in nutrition and biology who understand the issues associated with urban agriculture, the importance of specialty crops and the ability to incorporate or support similar initiatives in the future.

The University benefited from this program through the development of research initiatives in sustainable food systems for both students and faculty and improved curriculum through access to a living classroom.

Lessons Learned

Initially the difficulty faced was identifying an urban lot that was safe for food production and available through the university in a timely manner. An unfortunate byproduct of urbanization and industrialization has been the contamination of soil with toxic heavy metals. This experience underscores the importance of soil testing.

Once the space is available there is still the task of correct soil/light/access to be addressed. Through an internal partnership, the university assists with grounds maintenance – though training on the lethalness of weed whackers was needed. We were able to encourage and support an internal compost and mulch program – much can be gained from working the resources and initiatives already in existence. By seeking to serve on internal committees we were able to communication the needs of the program and gain support/propose initiatives that complement the orchard project.

The need to understand the impact of weather variability on crop production needs to become part of the project. We have initiated discussions with the Meteorology Department. There also needs to be greater consideration of the impact of university schedules on necessary orchard activities – particularly in the summer. In part, this was the impetus for the summer internship.

Pest control and insect management is a constant challenge – particularly for organic operations. As soon as you think you have a good plan and get the orchard planted, a new pest arrives – need to be flexible. Having access to the Illinois Fruit and Vegetable News and regular updating of resources such as Market Farming with Rotations and Cover Crops: An Organic Bio-Extensive System secondary to having completed the Beginning Farmers Training in Specialty Crops has been very helpful. We had a significant infestation of greater peach tree borer that took a significant toll on the stone fruit trees – and have initiated a nematode program in response.

All the efforts have been worth it – the orchard is a beautiful addition to the neighborhood.

Contact Person

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Additional Information

Viticulture Resources:

Mildred Mattfeldt-Beman PhD, RD, LD
Thomas Beman, JD

Construction:

http://viticulture.hort.iastate.edu/info/pdf/domototrellis.pdf

This is the web site we used – gives a great overview of the various options for constructing a vineyard trellis.

A grape trellis serves as a framework for training and supporting the vines.

- Must be strong enough to support large crops and withstand high winds.
- Must last 20 or more years with routine maintenance.

Major Trellis Components:

- Posts: Wood (preferred), steel, or other material spaced 21, 24 or 28 ft. apart
  - Dependent on vine spacing
- Strong end-post design
  - Anchored: earth anchor, tie-back post, or deadman for rows less than 600 ft.
  - Braced: H-brace or slant brace for rows over 600 ft.
- High-tensile galvanized steel wire
  - High cordon, or Kniffen: 1 to 3 wires
  - Vertical shoot positioning: 5 to 7 wires
  - Geneva Double Curtain: 3 or 4 wires

Trellis Post Materials Trellis Post Materials

Red, southern yellow, or lodgepole pine:

- Pressure-treated with chromated copper arsenate (CCA).
- Life expectancy of 20 to 30 years (suppliers should be able to provide a guarantee).

Steel stakes:

- Can be substituted for line posts.
- Subject to bending and leaning.
- Should be used in combination with wood posts.

Other alternatives:

- Native timber
- Fiberglass
- Recycled plastic
- Reinforced concrete

Vines between Posts

	Post Spacing		
Vine Spacing	21 ft.	24 ft.	28 ft.
6 ft.	--	4	--
7 ft.	3	--	4
9 ft.	--	3	--

- Vine vigor determines vine spacing in the row, and thereby affects post spacing. **Do not exceed 30 ft. between posts.**
- Equipment size, degree of side slope & training system often determines the spacing between rows

Trellising Hardware:
https://www.midwestvineyardsupply.com/about.asp
http://www.orchardvalleysupply.com/

12.5 gauge High-tensile Wire

Spinning Jenny - A dispenser used for coils of trellis wire aiding in convenient stringing of wire in the field.

Wire strainers

Crimping sleeve:

Tension indicator Spring:

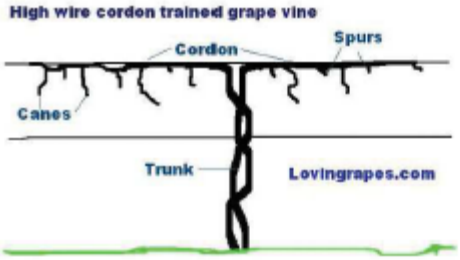
Wire vise:

Gripple :

Preferred Wire for a Vineyard Trellis:

- **Line wire:** 12.5 gauge High-tensile
- **Brace wire**: 9 gauge Low Carbon
  - High-tensile wire cannot be twisted.
  - Wires have similar yield and breaking points.
  - Because high-tensile wire is not very subject to stretching, the tension on the wire should be reduced during the winter.
    - Estimated that a temperature drop from 80 o to -20 o F can increase the tension on 500 ft. of 12.5 gauge high-tensile wire by 130 pounds due to shrinkage.
    - Tension indicator springs will absorb most of the additional tension.

High Cordon System: ("Single Curtain, Bi-lateral Cordon")
Suited for American and many French-American hybrid cultivars with a trailing / drooping growth habit



Resources: Care and management of Grapes

Cornell University Grape management
https://blogs.cornell.edu/nnygrapeupdate/2014/08/05/marquette-veraison-2014/

University of Kentucky – Pruning, training, and canopy management (Midwest)
https://www.uky.edu/Ag/CCD/vinemanagement.pdf

Iowa State University – Pruning, training, and canopy management
http://www.grapes.umn.edu/prod/groups/cfans/@pub/@cfans/@grapes/documents/asset/cfans_asset_374705.pdf

Missouri State University
http://mtngrv.missouristate.edu/assets/publications/ms29grapeguide.pdf

Tips:
http://www.gardenguides.com/70110-tips-planting-grapes-missouri.html

SLU Teaching Orchard

Viticulture Training

Join the Department of Nutrition and Dietetics as we learn from Saint Louis University Professor, Dr. Mildred Mattfeldt-Beman and University of Missouri, Viticulture and Wine Operations Specialist, Dean Volenberg.

Learn How To…

- Build cordons and support systems
- Plant & train grape vines
- Manage pests
- Select varieties of grapes

Friday
3:30-5:30pm
November 6th

Please contact Marian Linck at 314-977-8523 to sign up or email Marjorie Sawicki at sawickim@slu.edu for more information. For street parking, use 3217 Caroline Street, St. Louis, MO 63104.

Project 6: Honey Production Social Awareness Program

In2Action
Dan Hanneken
Final Performance Report

Project Summary

Recent declines in bee populations have impacted the agricultural industry while contributing to a decline in honey production. Increased honey cost have led many people to choose less expensive and more accessible alternatives. **Need (The Product):** Colony collapse disorder (CCD) is a phenomenon in which worker bees from a beehive or European honey bee colony abruptly disappear. While such disappearances have occurred throughout the history of apiculture, the term *colony collapse disorder* was first applied to a drastic rise in the number of disappearances of Western honey bee colonies in North America in late 2006 (Pennsylvania State University College of Agricultural Sciences. 2007).

The following was published in April of 2012; "domestic honey production dropped 16 percent in 2011 from 2010 as the number of bee colonies fell 7.5 percent and yield per colony declined 9 percent. In total, the crop reduction was 28.1 million pounds of honey, despite record-high average prices received by honey producers in both 2010 and 2011." (www.wherefoodcomesfrom.com/Article.aspx?ArticleID=3062). "Very little domestic honey remains available for sale and packers are making an effort to buy small lots, if necessary, to continue providing product to their retail trade." (www.americanbeejournal.com/site/epage/86437_828.htm). With a continuing world shortage of honey, prices are expected to remain high for the foreseeable future. **Need (The People):** Many nutritional and health benefits can be attributed to the consumption/use of natural honey. Unfortunately, many in our community are not educated on the various benefits or uses for natural honey. The poor in our communities (who could likely benefit the most) are often forced to choose less expensive alternatives over natural honey. Aside from the lack of availability and high cost, the lack of accurate nutritional information about natural honey also contributes to declining competiveness for locally produced honey.

The Honey Production Social Awareness Program (HPSAP) is an innovative model designed to accomplish three things: 1) increase local production and accessibility of natural honey, 2) educate the community on the nutritional, health, and medicinal benefits associated with honey consumption/use, and 3) develop and test a model which is sustainable and has already generated interest to be replicated at the state level. Individuals and families living at or near the poverty line will be specifically targeted for educational opportunities in which locally produced honey will be provided as an incentive for participation. The Missouri Department of Corrections will be targeted for state-wide replication. The needs stated above provide the motivation for this project and the relationship Project Manager Dan Hanneken has with present executive staff at the Missouri Department of Corrections made this project, and specifically the potential inclusion of bee hives within the prisons, a timely proposal.

The Honey Production Social Awareness Program is a start-up program. This project therefore does not compliment or enhance previously completed work.

Project Approach

Upon receipt of grant award in2Action ordered the materials for 50 beehives. Each completed hive to approximately 40 hours to assemble, paint, and deliver to the bee yard. While the hives were being assembled Hilltop Acres was enhancing bee habitat on the land surrounding the area around the bee yard. Clover was planted to increase the food supply. After all the hives were installed bees were introduced and through the first season appeared to do pretty well. A record cold winter however devastated our population and by spring we had only 10 viable hives. We made every attempt to nurture the bees through the winter but still lost 40 hives. We experienced additional losses through the spring as several of the remaining hived appeared to have swarmed. We made several attempts to split hives; however the yard presently has four thriving hives and two weaker hives. Because this project was designed to continue long after funding expires – we remain hopeful to establish 50 thriving hives in the years to come.

Regarding the Honey Makes Sense Classes, it proved very challenging to keep the attention of groups when presenting materials. We modified our approach and instead provided education one-on-one and we were able to serve 98 people in this way. It was our experience participants were able to much better understand the material when presented in this way. Each participant was provided a pint of honey and we also provided homemade cookies made with honey. Finally, Dan Hanneken managed the grant and did so from the perspective of potentially introducing beehives into the Department of Corrections Restorative Justice Gardens for the purpose of increasing produce, increasing bee populations, and producing honey. Hanneken tracked the implementation of the project from building the hives, to introducing bees, to harvesting honey. This, in combination with a literature review and a site visit from the Restorative Justice Coordinator led to the development of a feasibility study which was presented to the Missouri Department of Corrections.

Project partners included Hilltop Acres, Lees Bees, and volunteers Sara and Joe Haslag. The role of Hilltop Acres was to provide the much needed land from which to launch the bee yard. Hilltop Acres additionally provided 84.5 hours of consulting. Lees Bees provided consultation on both the assembly of the hives as well as beekeeping. Lees Bees provided 75.5 hours of consulting on this project. Sara and Joe Haslag served as our volunteer beekeepers. They provided a combined 316.5 hours of in-kind services to this project. Each partner attended at least one Missouri Beekeepers Association State Conference.

Goals and Outcomes Achieved

Goal One Activities: Increased production and accessibility of locally produced honey was accomplished through the purchase, assembly, and placement of 50 beehives. GEMS Hilltop Acres, LLC devoted 40 acres of land in Cooper County for the purpose of enhancing bee habitat, and raising bees to produce honey for public good. All the honey produced was provided for community good and provided as incentives for 98 participants in the “Honey Makes Sense” educational programs. Families living in poverty were specifically targeted and given priority consideration for educational classes.

Goal Two Activities: Increased knowledge about the nutritional, health, and medicinal benefits of locally produced natural honey was accomplished through “Honey Makes Sense” events. Education occurred in Columbia, MO at various not-for-profit agencies known to provide services for under-served populations. Honey was provided as an incentive to all 98

participants. Homemade food items made with pure honey were also available at the events for participants to sample. “Honey makes Sense” events will included information on how honey is harvested, nutritional value, potential medicinal benefits, and cooking recipes. Honey Makes Sense events in combination with HPSAP honey incentives to the poor increased the likelihood they would purchase and consume locally produced honey by 80% according to self-report survey data.

Goal Three Activities: Before the HPSAP model can be replicated in the Missouri prison system, it had to be formally evaluated. The grant recipient In2Action is a registered 501(c)3 which provides transitional support to people returning from incarceration and has a working relationship with the Missouri Department of Corrections. In 2011 the Missouri Department of Corrections donated over 50 tons of produce to local food pantries as part of their Restorative Justice Garden Program http://doc.mo.gov/pressreleases/2011/20111011.pdf. Dan Hanneken, Director of In2Action collected information from the Honey Production Social Awareness Program and created a report for the Missouri Department of Corrections. Prior to creating the report Hanneken met with Restorative Justice Coordinator Jeananne Markway to provide a tour of the bee yard and to receive specific instructions with regard to what information would be needed in the final feasibility study.

No “long term” outcomes were projected however the project provided the start-up funding needed to establish 50 hives and a bee yard which can now operate independent of grant funding.

Goal One - Measurable Outcome: Fifty hives assembled and installed and 150 pints of honey donated.
Completed: All 50 hives were assembled and installed and 168 pints of honey were provided as incentives to needy individuals and families.

Goal Two - Measurable Outcome: Over 75% of “Honey Makes Sense” participants will report they are better educated about honey and more likely to purchase local honey based on pre/post test surveys collected at events. Completed: Seventy five percent (75%) of participants (74 of 98) responded to the post test question about increased knowledge and likelihood to purchase local honey. Just over 90% of those who responded (68 of 74) reported they are now “more likely to purchase local honey over sugar than before the Honey Makes Sense Class”.

Goal Three - Measurable Outcome: A final feasibility report will be submitted to the Missouri Department of Corrections followed by a face to face meeting. Semi-Completed: A final feasibility has been submitted to the Missouri Department of Corrections however the face to face “following” the report was replaced with a face to face prior to the report and took place at the bee yard. Mr. Hanneken has extended an invitation to meet with the Department of Corrections at any point in the future should the Department of Corrections desire a formal presentation.

Beneficiaries

It is believed the Missouri Department of Corrections can benefit from this project because the final report and visit with Dan Hanneken will provide the information they need to decide if incorporating beehives onto their Restorative Justice Gardens is feasible. It is believed lower

income individuals and families in the Columbia area can benefit from this project because those who participated in our Honey Makes Sense Classes are now better educated about the various health benefits of consuming locally produced honey. It is believed the local beekeepers can benefit from this project because if indeed our Honey Makes Sense Classes were effective, those participants will purchase locally produced honey at a higher rate than prior to the classes. It is believed the agriculture industry in Cooper County can benefit from this project because the installation of 50 beehives will increase the bee population in the area and more bees are correlated with higher production numbers for many agricultural projects. The local economy can benefit from the project as the honey produced from the 50 hives can be sold locally and the revenues will remain in the local community.

A total of 168 pints of honey were provided as incentives to needy individuals and families. At $10/pint (retail) this provided $1,680 of product to the needy. The average beehive in Missouri produces an average of 47 pounds of honey per year. Wholesale prices for a pound of honey is about $6.00 so 50 hives producing 47 pounds of honey would contribute over $14,000 to the local economy each year.

Lessons Learned

While community members seemed genuinely interested in beekeeping and information about benefits of locally produced honey, we learned most of the people we engaged were not well informed. While we planned carefully and recruited a respectable bee consultant, we learned that bees, and the weather, and other factors beyond our control can negatively affect the success of a project such as this. We expected to have at least 45 viable hives at this point however we now realize this was not realistic. While the Department of Corrections was actively engaged and eager to pursue incorporating bee hives onto to the Restorative Justice Gardens, we learned they have to consider factors which outside of the Department of Corrections would be no issue at all. Specifically, the Department of Corrections does not feel it can overcome the obstacle of a potential law suit from an offender who might be stung by a bee.

As mentioned above – we did not expect to have the challenges we have establishing 50 viable hives. Additionally we did not expect potential bee stings with offenders at the Missouri Department of Corrections to be a possible deal breaker.

We did achieve our measurable outcomes which was only possible because we were careful to not over- promise on our original proposal.

Contact Information

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Additional Information

As noted above – it appears the risk of bee stings and subsequent law suits from offenders have become a major obstacle for the Missouri Department of Corrections. It is not clear at this time how this might be overcome. We are told by beekeepers it is not realistic to think one could 100% guarantee that no one would get stung. The feasibility report however was submitted and Dan Hanneken remains available should the Department desire any additional information.

While we have been disappointed to have only six hives of fifty active at this time, our team is committed long-term to this project and is able to move forward without additional grant support. We are grateful for this opportunity and look forward to fifty viable hives producing honey and bees in the years to come.

Feasibility Report provided to Missouri Department of Corrections in October 2014 as follows:

In2Actio
n
Final Report to
the
Missouri Department of Corrections
for
the
Feasibility of Implementing Beehives in Restorative Justice Gardens

Executive Summary

The Restorative Justice Program at the Missouri Department of Corrections encourages offenders to reflect on the harm caused by their criminal activity and to make restoration to victims, the community and their families. In FY 13 over 1,079,900 hours were volunteered by offenders in the institutions on reparative activities. Community volunteers help oversee some of these projects in the institutions. Products were delivered to shelters, daycare centers, nursing homes, meals on wheels program, hospitals, victims, schools, not-for-profit organizations, etc… across the state. In CY 13, approximately 325,748 lbs of produce was delivered to shelters, schools, food banks, senior citizen homes, etc... across the state of Missouri. This produce was grown in the restorative justice gardens.

The purpose of this report will be to assess the feasibility of implementing bee-keeping and honey production to the already very successful restorative justice gardens within the Missouri Department of Corrections.

Potential Benefits

Increased garden produce: "We need pollinators for global functioning and a livable planet,"

says Winfree, an assistant professor of entomology at Rutgers University in New Brunswick, NJ. “Eighty to 90 percent of plant species rely on animal pollinators.” The importance of pollinators is well recognized by gardeners and organic farmers. Bees, the most important pollinators in most ecosystems, sometimes spend upwards of 10 hours a day bouncing from flower to flower, collecting nectar and pollen to feed their offspring. In the process, they help boost crop production. Of all the different global food crop species, 75 percent benefit from pollinators, meaning they set more fruit or produce more seed. Not all rely entirely on pollinators, but many crops will do nothing without pollinating critters’ help. The addition of bee hives to restorative justice gardens can increase the amount of fruit and vegetables each garden produces which will increase the amount donated to various agencies across the state.

Access to honey for economically disadvantaged: Many nutritional and health benefits can be attributed to the consumption/use of natural honey. Unfortunately, many in our community are not educated on the various benefits or uses of natural honey. The poor in our communities (who could likely benefit the most) are often forced to choose less expensive alternatives over natural honey. Aside from the lack of availability and high cost, the lack of accurate nutritional information about natural honey also contributes to declining competiveness for locally produced honey. All the donations from restorative justice gardens go to agencies serving our disadvantaged. The average bee hive in the State of Missouri produces an average of 47 pounds of honey which would all be donated to the poor adding to the present contributions noted above.

Increased bee population: Honeybees and wild bees are the most important pollinators of many of the fruits and vegetables we eat. Of 100 crop species that provide 90% of our global food supply, 71 are bee-pollinated. The value of pollination of food crops by bees in the U.S. alone is estimated at $16 billion and insect pollinators in general contribute $29 billion to U.S. farm income. Fewer bees lead to lower availability and potentially higher prices of fruit and vegetables. Fewer bees mean no almonds, less coffee and less alfalfa hay available to feed dairy cows.

Colony collapse disorder (CCD) is a phenomenon in which worker bees from a beehive or European honey bee colony abruptly disappear. While such disappearances have occurred throughout the history of apiculture, the term *colony collapse disorder* was first applied to a drastic rise in the number of disappearances of Western honey bee colonies in North America in late 2006 (Pennsylvania State University College of Agricultural Sciences. 2007). The following was published in April of 2012; “domestic honey production dropped 16 percent in 2011 from 2010 as the number of bee colonies fell 7.5 percent and yield per colony declined 9 percent. In total, the crop reduction was 28.1 million pounds of honey, despite record-high average prices received by honey producers in both 2010 and 2011.” (www.wherefoodcomesfrom.com/Article.aspx?ArticleID=3062).

The proposed project could potentially impact CCD by cultivating bee populations in over 20 Missouri prisons located all over the state.

Project Description

Pilot Program: Implementing bee-keeping at restorative justice gardens would begin with a pilot program at a single institution. Because “offender bee-keepers” will require training, it is suggested the pilot sight be a higher level institution in which trained offenders are expected to stay for over two years. It is expected the average restorative justice garden could support two to three hives. Local beekeeping associations can be accessed to provide support, training, education, and oversight for the project. It is possible the hives themselves might be donated by such associations. For a list of the local beekeeping associations and appropriate contact people go to http://mostatebeekeepers.org/local-associations/.

Wide Scale Implementation: After the pilot program proves successful, the Department of Corrections can expand the program statewide. Offenders working at Missouri Vocational Enterprises (MVE) could be responsible for building bee hives. The assembly of pre-cut bee hive kits takes approximately four hours, however overall costs can be reduced if MVE made the hives from raw materials which would increase labor hours to approximately eight hours per hive. Many public websites provide plans and material lists from building bee hives. Several activities can be taking place at the institutions while the hives are being built. Local beekeeping associations can begin training “offender beekeepers” while also assessing the surrounding bee habitat. Hives are best started in the spring at which time bees will be introduced. Starter bees are purchased as a “nuc” which includes approximately three pounds of bees plus a queen bee which is sufficient to start a hive. It is not expected hives will produce enough honey in year one to harvest, however established hives in the Missouri yield an average of 37 pounds of honey per year. Thriving hives require approximately five hours of attention per month. Struggling hives may require more time. While one or two “offender beekeepers” are needed to ensure proper care of hives, it is suggested each institution have three to five trained offenders so back-ups are available in cases of transfers, releases, disciplinary actions, etc.

Recommendations & Findings

A two year project funded by the federal Specialty Crop Block Grant through the Missouri Department of Agriculture has contributed to the findings of this report. The grant recipient in2Action utilized a recently released offender with below average work skills to assemble hives. It took approximately 12 hours of one-on-one training before the offender was able to independently build quality hives. The trainer is not required to have beekeeping experience but rather construction experience which is readily available at Missouri Vocational Enterprises.

After hives are built they will be placed in restorative justice gardens and bees introduced. Introducing bees to a hive requires specialized knowledge and skills and it is not realistic to expect offenders to possess or acquire such skills. The Missouri Department of Corrections would be required to partner with local beekeeping associations to complete this part of the process. In2Action was able to easily recruit such support, free of charge, and believes the Department of Corrections will be able to do the same. Beekeepers tend to be very passionate about their work and freely share information and are often eager to support and volunteer with others learning the business.

After bees are introduced hives need to be maintained. Offenders can be trained to maintain hives which will consist of checking to ensure the bees are healthy, the hives are free from infestation, and there is plenty of food. While determining how many hives an area can support is not an exact science, it is expected most institutions can expect to be able to support three to five hives.

Year one will primarily focus on "establishing" the hive which will likely include feeding the bees in the winter. After hives are established, usually year two, honey can then be harvested and winter feedings will no longer be needed. Offenders can be easily trained to extract, clean, and package the honey to be donated to local food panties and other non-profit organizations.

Budget

- Unassembled Hives ($200/each): The price includes all the materials needed to build a complete hive including two-supers, cover, and foundation. Unassembled hives come as a kit with all the wood precut and drilled. Cost can be reduced by building hives from scratch and free plans are available online.
- Bees ($100/nuc): Bees are purchased as a "nuc" which includes one queen and approximately three pounds of bees. Each new hive will require one nuc. In some cases, if an institution has a well established hive, it may be possible to split that hive to start another.
- Bee Suit ($95/each): Each institution will need two bee suits to protect offender beekeepers. Bee suits can be used by different offenders.
- Helmet/Veil ($24/each): Each institution will need two helmet/veils to protect offender beekeepers. Helmet/veils can be used by different offenders.
- Bee gloves ($26/each): Each institution will need two pairs of bee gloves to protect offender beekeepers. Bee gloves can be used by different offenders.

Project 7: Winery Passport Program

Missouri Wine & Grape Board
Jim Anderson, Executive Director
Final Performance Report

Project Summary

The Missouri Wine and Grape Board is charged with providing programs to support all of the wineries across the state. As the number of wineries continues to increase, this becomes a greater challenge.

The Passport Program was launched in February of 2010 to increase wine sales through the promotion of consumer visits to wineries. Passports can be picked up at participating wineries or requested on missouriwine.org. Each participating Missouri winery has a passport display with a unique code and stamp. Participants can obtain this code and get their passport stamped by visiting the winery. They may only visit each winery once for credit, encouraging consumers to experience new wineries. Once a patron visits at least four wineries they log in to our website to enter their information and receive a complementary reward from the Missouri Wine and Grape Board.

There are seven levels of redemption, rewarding customers for up to 95 winery visits.

Level 1: Four Winery Visits
Reward: Bar Towel

Level 2: Eight Winery Visits
Reward: Deluxe wine opener

Level 3: 12 Winery Visits
Reward: Missouri Wine Apron

Level 4: 20 Winery Visits
Reward: Neoprene Carrier

Level 5: 40 Winery Visits
Reward: Private food and wine pairing for 10

Project Approach

The Missouri Wine and Grape Board coordinates marketing and public relations activities with wholesalers, restaurant operators, retailers, and the public to strengthen interest in, and patronage of, our state's grapes, grape juice, and wine industry. In an effort to increase winery tourism and wine sales, the Missouri Wine and Grape Board launched a passport program in February of 2010. The program was instantly popular among winery customers and there are currently over 7,000 participants in the program with an average of 150 new participants every week. As passport participants reach new levels they are rewarded with items, increasing in value at each level. While this program has proved to be successful at driving consumers to the winery and increasing winery tourism, it has also been expensive to support and maintain. This program is free to both the winery and consumer to participate and is funded fully by the Missouri Wine and Grape Board. Securing additional funds for the passport program ensured that we continued the program for another year and continued to increase winery visits and sales and ultimately positively affect the economic impact the Missouri wine industry and tourism has on the state of Missouri. Funds were used for printing, packaging and mailing of passports.

Goals & Outcomes Achieved

Goals**:**

One of the most valuable aspects of the passport program is the information we have access to from the participating consumers. When participants in the passport program enter their winery stamps and codes into our website, they are asked a series of questions pertaining to their winery visit, including the amount spent at the winery and their experience at the winery. This survey allows us to track where they have been and how much they spend on average at the winery. We are also able to provide consumer comments to the winery from a non-biased, third party. This information allows us to have detailed reports about consumer behavior at the winery and accurately measure anticipated outcomes, which are:

- Increase winery visits/tourism across state by 150,000
    - Monitored through cumulative end of program report (by multiplying number of participants by recorded visits).
- Increase wine sales by 2%
    - Monitored by annual gallon report which is comprised of all wine sales in the state.
- Increase reach by 2,500 (new passport participants)
    - Monitored weekly through online reports.
- Deepen brand loyalty (among those already in the program)
    - Monitored by tracking the number of participants that advance from one level to the next through our weekly online reports.
- Provide detailed feedback to wineries (improve customer service and wine quality)
    - Monitored by monthly reports that track the number of winery visits recorded through the online survey.

Outcomes:

- Total Passport Users
    - 12,216
- Level 1 total redemptions
    - 10,152
    - $45,677
- Level 2 total redemptions
    - 6,127
    - $30,460
- Level 3 total redemptions
    - 4,035
    - $40,518
- Level 4 total redemptions
    - 2,206
    - $19,846
- Level 5 total
    - 830 achieved/$83,000
    - 221 redeemed/$22,100
- Level 6 total

    - 258 achieved/$38,700
    - 75 redeemed/$11,250
- Level 7 total
    - 62 achieved/$18,600
    - 15 redeemed/$4,500
- Total redemptions to date
    - $174,351

Total Costs = $323,968
- $25,000 specialty crop grant
Total Amount Spent = $298,968
Potential Level 5-7 redemptions through June 15, 2013 = $102,450
Total Potential Costs = $401,418

All of these items help us increase the economic impact of the Missouri wine industry. The number of participants in 2013 was 11,335 equaling 30,055 winery visits. We do not have numbers yet for the 2013 sale of wine. We have just received our 2013 figures and unfortunately we have a decrease in sales, but up from the year before.

Beneficiaries

The beneficiaries of this research are the 118 winery owners and many more grape growers across the state. The results of the research were presented to industry leaders at Marketing and Board meetings.

Lessons Learned

The over 120 wineries in the state in conjunction with the Missouri Wine and Grape Board are considered grant partners as they benefit most from this program. The MWGB is committed to continuing the Passport Program for another year in an effort to increase winery traffic and sales. The percent of decrease has slowed. There has been a glut of wine and grape products in Missouri.

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Project 8: Developing and Optimizing Nitrogen Applications to Enhance Chestnut Production

University of Missouri

Dr. Michele Warmund
Final Performance Report

Project Summary

Nitrogen fertilization is required for adequate tree growth and the production of large, high quality chestnuts. Unlike most other fruit and nut crops, the optimal nitrogen application rate for chestnut trees grown in Missouri was unknown. Thus, five rates of nitrogen were evaluated to develop new grower recommendations for nitrogen applications based upon the optimal rate at which 'Peach' Chinese chestnut trees had enhanced tree growth and nut yield. Results from this study demonstrated that cumulative nut yield, total nut number, tree growth, and foliar nitrogen content increased linearly when nitrogen was applied at 56 to 168 kg/ha (50 to 150 lbs/acre) over a four year period. Also, nitrogen applied at 140 kg/ha (125 lbs/acre) increased cumulative nut yield as compared to rates at or below 84 kg/ha (75 lbs/acre). Based on these results, the newly-developed nitrogen recommendation is to apply 140kg/ha when producers do not use foliar analysis to determine their annual nitrogen application rate. New recommendations for foliar sampling are to select five fully-expanded mid-shoot leaves from bur-bearing shoots between July 15 and August 1. When chestnut producers obtain foliar samples for evaluation, an appropriate nitrogen rate will be recommended based on their previous year's rate when the foliar nitrogen content is below 2.4%. These research-based recommendations will enhance nut production and tree growth for chestnut growers. This projected did not build on a previously funded project with SCBGP or SCBGP-FB.

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Project Approach

Chestnut is a relatively new specialty crop grown in Missouri. Because of the potential for high economic returns, the University of Missouri Center for Agroforestry (UMCA) has set a goal of 2000 acres of chestnuts planted in Missouri by 2020. Based on economic projections, this would inject $4 to 7 million for wholesale nuts and up to $20 million for retail nuts into the economy. To meet this goal, UMCA has conducted producer workshops to educate growers on best agricultural practices for this crop. However, because chestnut production is a niche crop in Missouri, some aspects of production such as optimal rates for nitrogen fertilization are unknown. Previous UMCA recommendations for mature, bearing chestnut trees (100 lbs/acre annually) were based on hazelnut recommendations from Oregon. Thus, there was a paucity of research-based information on the optimal rate of nitrogen where tree growth and yield are enhanced without supplying excess fertilizer. The purpose of the project was to determine the effect of various application rates of nitrogen on the vegetative growth and nut yield of Chinese chestnut trees and to develop research-based nitrogen recommendations for this crop, which will be communicated to producers, as well as researchers/extension personnel across the U.S.

In spring 2008, 'Peach' chestnut scions were grafted onto AU-Cropper seedling rootstocks and trees were planted at the University of Missouri Horticulture and Agroforestry Research Center, New Franklin, MO in spring 2009. To evaluate the effect of five rates of NH_4NO_3 on vegetative growth and fruiting of Chinese chestnut trees, nine, single-tree replications of each treatment were used in this study. In 2009, 2010, and 2011 all trees received 45, 90, and 136 g N/tree (0.1, 0.2, and 0.3 lb N/tree), respectively. In 2012, 2013, 2014, and 2015, split applications of the five different rates [56, 84, 112, 140, and 168 kg/ha (50, 75,100,125 and 150 lbs/A)] of nitrogen were applied on Apr. 1 and June 15. As a project partner, University of Missouri

personnel assisted in the maintenance of research plots. Trunk circumference, vegetative shoot growth, and nut number and yields were recorded annually. Foliar samples were also collected in mid-July to assess foliar nitrogen annually by the Kjeldhal method at the University of Missouri Soil and Plant Testing Laboratory. Annual and cumulative data were subjected to analysis of variance using the proc glimmix procedure of SAS. Means were separated by Fisher's protected least significant difference test at $P \leq 0.05$. When statistical differences were found, orthogonal contrasts were performed to evaluate the effect of nitrogen rate on growth and fruiting parameters.

Results from this study demonstrated a linear increase in cumulative nut yield and nut number as the rate of nitrogen increased (Table 1). Mean nut weight was similar among all rates of nitrogen. Annual nut yield, number, or average weight did not differ in 2015. Increase in trunk circumference and foliar nitrogen content from bur-bearing shoots was greater at the 112, 140, and 168 kg/ha rates than the 56 kg/ha rate (Tables 1 and 2). Results obtained in 2014 demonstrated that foliar nitrogen content of bur-bearing shoots was lower that of vegetative shoots. Based on these results, the new recommended rate of nitrogen for enhanced chestnut tree and nut yield is 140 kg/ha. When sampling for foliar nitrogen, five fully-expanded, mid-shoot leaves from bur-bearing shoots should be sampled between July 15 and August 1and 2.4% nitrogen is sufficient for optimal chestnut tree growth and yield.

Goals and Outcomes Achieved

Research results from this study were presented to about 500 researchers and extension workers at the American Society for Horticultural Science annual conference held in Orlando, Florida on July 30, 2014. A presentation with research results was also delivered to 125 chestnut growers at the Northern Nut Growers conference in Corvallis, Oregon on August 13, 2014. A manuscript will be submitted to the Journal of the American Pomological Society. Previously, nitrogen recommendations were not based on research data collected on chestnut trees. As a result of this study, new recommendations for annual nitrogen application rates have been developed. The new recommended rate for nitrogen application is 140 kg/ha when foliar sampling is not conducted. When foliar sampling is conducted, it is recommended that five, fully-expanded mid-shoot leaves are obtained from bur-bearing shoots and 2.4% nitrogen will be considered the target foliar nitrogen content for optimal nut production and tree growth. When a producer submits a foliar sample with insufficient nitrogen, their recommended rate of nitrogen will be based on the 2.4% target. In addition to previous outreach activities, a journal article will be submitted to communicate the results of this study to a broader audience.

Lessons Learned

All goals of this project were achieved. Because 'Peach' chestnut trees had relatively low nut production until six years after planting, it was necessary to conduct this study until two marketable crops were harvested. An additional lesson learned from this study was the importance of sampling leaves from bur-bearing shoots and avoiding vegetative shoots to obtain an accurate estimate of foliar nitrogen.

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Additional Information

Table 1.

Table 1. Cumulative and annual (2015) yield, nut number and mean nut weight, and vegetative characteristics of 'Peach' Chinese chestnut trees treated with various rates of nitrogen.

Nitrogen	2012-2015					2015		
rate	Yield/tree	Nut	Mean nut	Terminal shoot	Increase in	Yield/tree	Nut	Nut wt.
(kg/ha)	(g)	no.	wt. (g)	growth (cm)	trunk circ. (cm)	(g)	no.	(g)
56	5145 b	306 b	16.8 a	26.3 a	18.1 c	2931 a	178 a	16.5 a
84	5083 b	311 b	16.3 a	27.4 a	19.6 bc	2847 a	183 a	15.6 a
112	5957 ab	380 ab	15.7 a	27.0 a	20.2 abc	3786 a	263 a	14.4 a
140	7288 a	464 a	15.73 a	26.9 a	21.3 a	4250 a	274 a	15.5 a
168	7494 a	493 a	15.2 a	26.5 a	22.4 a	4389 a	304 a	14.4 a
Significant effects								
Rate	L***	L***	NS	NS	L***	NS	NS	NS

Mean values represent 9 replications of each treatment. Means followed by different letters are significantly different ($P \leq 0.05$). Orthogonal contrasts were performed to test the trend of different nitrogen rates. L represents a significant linear response to nitrogen rate and NS represents a non-significant response.

Table 2. Percent nitrogen content of foliage from bur-bearing shoots of 'Peach' Chinese chestnut trees treated with various rates of nitrogen in 2015.

Nitrogen rate (kg/ha)	Foliar nitrogen content (%)
56	2.13 c
84	2.29 bc
112	2.33 ab
140	2.43 ab
168	2.51 a
Significant effects	
Rate	L***

Mean values represent 9 replications of each treatment. Means followed by different letters are significantly different ($P \leq 0.05$). L represents a significant linear response to nitrogen rate.

Project 9: Invasive Insect Pests Threatening Specialty Crops - Organic Management and Farmer Education

Lincoln University
Dr. Jaime Piñero
Final Performance Report

Project Summary

Invasive species increasingly pose potential and actual economic threats to U.S. agriculture and other sectors of the economy, and the Missouri's specialty crops sector is no exception. This project aimed at conducting research and outreach by providing farmers with awareness and training on the imminent arrival of the invasive insects Spotted Wing Drosophila (SWD) (*Drosophila suzukii*) and Brown Marmorated Stink Bug (BMSB), *Halyomorpha halis.* These two invasive insects are devastating pests of berries (SWD, BMSB) and vegetables (BMSB) and are known to cause serious economic losses to farmers. At the moment this project was funded these two pests were not present (yet) in Missouri; therefore it was imperative to implement an effective monitoring system that could detect their arrival into the state. This project was unique in the sense that it started, for the first time in MO, a monitoring system for BMSB and SWD; it had not been submitted to SCBGP or SCBGP-FB or to any other funding agency before. Project objective 1 was aimed at conducting research with another invasive insect pest that was been present in Missouri for several decades: Japanese beetle, *Popillia japonica*. In particular, this objective sought to develop and evaluate mass trapping as an organic approach to Japanese beetle management for use by small and mid-scale farmers. The second objective was to deploy monitoring systems for the BMSB and SWD. The third objective was to disseminate, through extension and outreach, the findings of our research and pest monitoring surveys with specialty crop producers and extension educators at the local and regional levels. All objectives were accomplished successfully and outputs and impacts exceeded our expectations. Derived from objective 1, we developed an effective and inexpensive mass trapping system that over a 4 year period showed to be able to trap over 8 million Japanese beetles without spraying a single drop of insecticide to the crops that were

being protected (blueberry, elderberry), and also without producing significant damage to those crops. From the second objective, our monitoring efforts paid off when in June 2013 our monitoring traps detected for the first time the presence of SWD in Missouri. This resulted in the production of fact sheets on monitoring and management options for farmers as well as pest alerts, Newsletter articles, and other methods of dissemination to make sure Missouri Department of Agriculture, APHIS, Univ. of Missouri, Lincoln University and other partner agencies and, more importantly, farmers, would learn about this invasion. Also in 2013, the first BMSB specimens were collected live in various locations of Missouri. In September 2015 the Lincoln University IPM program documented the presence of breeding populations in Ferguson, MO. Thousands of Missourians were alerted using media, and hundreds of farmers received free monitoring traps and bait, as well as identification kits that included fact sheets and slides or vials with real specimens (mounted). Overall, project activities resulted in documented impacts.

Project Approach

Below we provide a synthesis of the research and outreach activities that were accomplished during the grant period. All activities proposed in the approved project proposal were accomplished and in all cases the expectations were surpassed. The heavy work load associated with our research and outreach were leveraged with supplementary funding provided by other sources. For example, this project was heavy on student labor / casual worker; even though only $ 5,000 was allowed for salaries. Any additional salaries were covered by either Lincoln University or by supplementary sources. This exemplifies efficient use of resources by Lincoln University. The PI states that funds were used to solely enhance the competitiveness of specialty crops, in this case many types of berries and other fruits.

Objective 1: To develop and evaluate organic approaches to Japanese beetle management for use by small and mid-scale farmers.

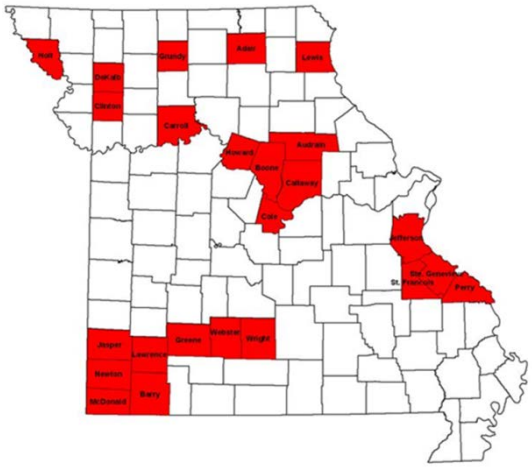
In Missouri, damaged caused by Japanese beetles (JB) has been increasing as populations continue to become established and expand. In a 2012 study, the effectiveness of commercial and home-made traps baited with either, one or two lures (a combination of a powerful sex pheromone and floral attractants) at capturing JB beetles at two Lincoln University (LU) farms and at one commercial elderberry farm in central Missouri was quantified. Over the course of five weeks, >1'550,000 JB were captured by traps in the two LU farms, and >1'120,000 JB were captured in the elderberry farm. The commercial trap baited with one lure proved to be the most cost-effective. Level of damage caused by JB averaged 2.5% in elderberry at one LU farm, and it was negligible in the other LU farm. At the commercial elderberry farm, level of damage was minimal in some areas whereas for other areas not well protected by traps damage reached 9.5%, yet still within acceptable levels by the farmer given that zero insecticides were applied. This technique has been refined and is expected to contribute to more effective management of this pest not only in Missouri, but also in other U.S. regions where JB is present.

From 2013 to 2015, additional research conducted at two Lincoln University farms and also at a couple of cooperating commercial farms (elderberry and blackberry) was focused on further assessments of the effectiveness of the mass

trapping system (see picture showing mass trapping device, on the right). Overall, over 8 million Japanese beetles were captured using the mass trapping system in four years (2012-2015) (see table below).

FARM	2012	2013	2014	2015	TOTAL
LU Carver farm	801,000	92,300	873,400	1'602,000	3'368,700
LU Busby farm	710,800	100,400	817,050	1'531,000	3'159,250
Elderberry farm (Hartsburg, MO)	1'161,200	93,100	----	----	1'254,300
Blackberry farm (Columbia, MO)	-----	89,350	265,950	----	355,300
TOTAL	**2'673,000**	**375,150**	**1'956,400**	**3'133,000**	**8'137,550**

Objective 2: To deploy monitoring systems for the invasive insects Brown Marmorated Stink Bug (BMSB) and Spotted Wing Drosophila (SWD) over a 2-year period.



Monitoring of SWD and BMSB was accomplished with the best traps and lures that were available based on research done throughout the USA. Thanks to funds provided by MDA, monitoring of both insect species started in early June, 2013. Soon after detecting the first SWD specimens captured in monitoring traps (in mid-June), the Lincoln University IPM program alerted farmers that Missouri fruit crops were at risk due to a confirmed invasion of this fly and that the best way to protect crops was to spray an effective insecticide. This was followed by numerous fact sheets, guide sheets, and presentations in farmers' conferences (see Objective 3). The map on the right shows the state counties where SWD had been reported by October, 2013. Some farmers were able to save their fruits by spraying insecticides but unfortunately, many farmers experienced substantial economic losses due to larval infestations caused by SWD to fruit. A no-cost extension was requested (and approved) so that the Lincoln University IPM program could extend the period of monitoring for a third year (2015).

Objective 3: To disseminate, through extension and outreach, the findings of our research and pest monitoring surveys with specialty crop producers and extension educators at the local and regional levels

Given that the PI of this project has a split research / extension appointment, then major efforts were made to disseminate research-based information about the biology, monitoring tools and management of both species. The specific extension / outreach activities that were conducted over a 3-year period are listed below.

Links connecting to Newspaper, NPR Harvest Public Media websites and other media where SWD was discussed, based on information provided by the LU IPM Program:

August 8, 2013

http://interact.stltoday.com/pr/local-news/PR080813113313888

~~http://gasconade.countynewslive.com/content/2013/aug/08/lincoln-university-cooperative-extension-issues-alert-missouri-fruit-growers~~ Delete

http://www.marshallnews.com/blogs/1550/entry/58417 Replacement Link

http://pressreleases.kcstar.com/release/messages/49023/

http://farmprogress.com/story-fruit-growers-face-new-pest-9-100337

August 28, 2013

http://www.stlamerican.com/news/community_news/article_42415734-1056-11e3-af39-0019bb2963f4.html

September 5, 2013

http://kbia.org/post/newly-arrived-pest-damaging-midwest-fruit-crops
http://harvestpublicmedia.org/content/newly-arrived-pest-damages-fruit-crops-missouri-spotted-wing-drosophila#.Uiee6sashcY

~~http://southcountymail.com/n2rogersville/special-conference-for-missouri-blueberry-growers-takes-place-late-february/article_c993f30c-8bb9-11e3-97eb-0019bb2963f4.html~~ Delete

Replacement Links:

http://extension.missouri.edu/blueberry

http://missouribeginningfarming.blogspot.com/2014/01/missouri-blueberry-school-conference.html

http://friendsofthegarden.org/fog-blog/2015/02/18/the-2015-missouri-blueberry-school-in-springfield-march-13-14/

Newsletters:

~~http://movegetablegrowers.org/home/attachments/category/258/augustNewsletter13.pdf~~ - Delete

http://ipm.missouri.edu/meg/2013/8/Detecting-larval-infestations-and-insecticidal-options-for-Spotted-Wing-Drosophila-a-significant-pest-of-small-fruit-crops-in-Missouri/

http://ipm.missouri.edu/meg/2013/8/Integrated-Pest-Management-of-Spotted-Wing-Drosophila-with-Emphasis-in-High-Tunnel-Grown-Fall-Bearing-Primocane-Raspberries/

Extension publications (fact sheets, guide sheets, etc.)

Wilson, J.T. and **Piñero, J.C.** 2015. The Basics of Organic Insect Pest Management. Lincoln University Cooperative Extension IPM program Guide Sheet. GS#18-F-2015, 5/08/2015.

2015 One presentation titled “Spotted Wing Drosophila/Brown Marmorated Stink Bug Update” at the Great Plains Growers Conference, held in St. Joseph, MO (Jan. 8-10) (Audience: 25 farmers)

Wilson, J.T. and **Piñero, J.C.** 2014. The Japanese beetle. Lincoln University Cooperative Extension IPM program. LUCE FS#18-D-2014 07/10/2014.

Piñero, J.C. and Byers, P.L. 2014. The "1-2-3" IPM Approach for Spotted Wing Drosophila Management. Newsletter Article available at http://ipm.missouri.edu/IPCM/2014/5/The-1-2-3-IPM-Approach-for-Spotted-Wing-Drosophila-Management/

Piñero, J.C. 2014. Monitoring Systems in place for Brown-Marmorated-Stink-Bug-and-Spotted-Wing-Drosophila for 2014. Newsletter Article available at http://ipm.missouri.edu/IPCM/2014/5/Brown-Marmorated-Stink-Bug-and-Spotted-Wing-Drosophila/

Piñero, J.C. 2014. Detecting larval infestations and insecticidal options for Spotted Wing Drosophila with notes on insecticidal options. Lincoln University Cooperative Extension, IPM Program. LUCE GS#18-E-2014 11/25/2014.

2014 Introduction to Small Fruit Production – Growing Growers Kansas City. Presentation on Spotted Wing Drosophila: Pest of Small Fruits. Kansas City, MO (June 14) (Audience: 16 farmers).

2014 Two presentations at the Great Plains Growers Conference, held in St. Joseph, MO (Jan. 9-11). Topics: (1) Integrated Pest Management options for Spotted Wing Drosophila (Audience: 37 farmers), (2) Invasive Insects Threatening Vegetable Production in The Midwest (Audience: 65 farmers), and a poster “Spotted Wing Drosophila, a new invasive insect affecting small fruit production” by J. Piñero (Estimated audience: 150 farmers).

2014 Coordinated the “Spotted Wing Drosophila Clinic” at the Great Plains Growers Conference (January 9-11). Room was setup with educational materials, stereomicroscopes, free bait and traps, free samples of specimens for farmers to identify this pest at their farms were available. Extension educators from Lincoln University, Univ. of Missouri, Iowa State University and University of Nebraska – Lincoln supported this effort. At least 45 farmers visited the clinic.

2013 Co-presented two posters at the Entomological Society of America Annual Meeting (November 9-13), Austin, TX: (1) “Getting benefits out of a bad bug: On-farm composting of Japanese beetles, *Popillia japonica* (Coleoptera: Scarabaeidae)” (G. Ndunguru, H.Y. Johnson, J. Wilson, and J.C. Piñero); (2) “Mass trapping: A potential organic management option for the Japanese beetle (Coleoptera: Scarabaeidae)” (J. Wilson and J.C. Piñero).

2013 Poster presentation at the Midwest Organic and Sustainable Education Service (MOSES) conference held on February 21-23, 2013 in LaCrosse, WI. Audience: cannot be quantified, but conference is attended by 2,000+ organic farmers. Presented two posters: (1) Mass trapping: a potential organic management option for Japanese beetles, and (2) Getting Benefits Out of a Bad Bug by On-farm Composting Japanese Beetles”.

2013 Presentation titled “Managing Japanese Beetles in Elderberry”) by Mr. Jacob Wilson at the Elderberry symposium, field component held at Mr. Terry Durham farm in Hartsburg, MO on June 13, 2014. Audience: 45 farmers.

2013 Oral presentation titled “Update: Japanese beetles, Brown Marmorated Stink Bug and Spotted Wing Drosophila”. Speaker: Jaime Pinero. Presentation given on January 11, 2013 to approx. 35 farmers at the Great Plains Growers Conference (GPGC) held in St. Joseph, MO. This presentation focused on new useful information that has been gathered by numerous researchers around the country on the biology and management options for these three invasive pests.

2013 Oral presentation titled “Organic Management of Japanese Beetles” by Jacob Wilson given on January 11, 2013 to approx. 40 farmers at the GPGC held in St. Joseph, MO. It addressed current management options for Japanese beetles, including preliminary results from our research, and plans for 2013.

2013 Poster titled “Mass trapping: a potential organic management option for Japanese beetles” by Jaime Pinero and Jacob Wilson presented at the Midwest Organic Sustainable Education Service (MOSES) held in LaCrosse, WI on February 21-24, 2013. Unable to quantify how many people were reached with this poster (more than 4,000 farmers attended the conference).

2013 Oral presentation titled “Organic Management Options for Japanese Beetles” by Jacob Wilson given at the Annual Conference of the Missouri Organic Association held in Springfield, MO on February 7-9, 2013. Audience: 28 farmers.

2013 One article titled “Spotted Wing Drosophila, a real threat to the production of berries and other fruits in Missouri” was written by Jaime Pinero for inclusion in the MU/LU IPM Newsletter edited by James Quinn. It provided information about identification, biology, and monitoring of this invasive insect. About 300 farmers receive this quarterly newsletter. The text and pictures that were submitted for the IPM Newsletter are presented in Appendix I.

Piñero, J.C. **2013**. Detecting larval infestations and insecticidal options for Spotted Wing Drosophila. Lincoln University Cooperative Extension, IPM Program. FACT SHEET.

Piñero, J.C. and Byers, P. **2013**. Management Options for Spotted Wing Drosophila with emphasis on high-tunnel grown, fall-bearing primocane raspberries. Lincoln University Cooperative Extension, IPM Program. FACT SHEET.

Piñero, J.C. **2013**. Monitoring for Spotted Wing Drosophila, an Insect Pest of Berries and Other Fruits in Missouri. Lincoln University Cooperative Extension, IPM Program. FACT SHEET.

2013 Oral presentation at the Great Plains Growers Conference, held in St. Joseph, MO (Jan. 9-11) titled “Integrated Pest Management options for Spotted Wing Drosophila” by Dr. J.C. Piñero (Audience: 37 farmers).

2013 Oral presentation at the Great Plains Growers Conference, held in St. Joseph, MO (Jan. 9-11), titled “Invasive Insects Threatening Vegetable Production in The Midwest” by Dr. J.C. Piñero (Audience: 65 farmers).

2013 In-Service-Education Workshop on ‘Spotted Wing Drosophila’ was held on November 20, 2013. Audience: 51 Extension professionals from Univ. Missouri Extension, Lincoln University, Mo Department of Conservation, MO Department of Agriculture, and MO Master Naturalists.

Goals and Outcomes Achieved

***OUTCOMES AND IMPACTS FROM OUR RESEARCH*:** Results generated as part of this project generated new research-based information on organic management of Japanese beetles using a mass trapping system that was developed by the Lincoln University IPM program. Research has shown that this approach is effective when done at farms that have comparatively less attractive host such as blueberries. No insecticides (organic) have been applied in four years to any plant. Many farmers (over 2,000) learned (short-term outcome – *increase in knowledge*) about the effectiveness, simplicity and cost-benefit of this mass trapping system, and some (<20) have implemented mass trapping at their farms (mid-term outcome – *change in behavior*).

***OUTCOMES AND IMPACTS FROM SWD / BMSB MONITORING*:** The detection of SWD in June of 2013 prompted the implementation of numerous outreach activities to prepare farmers to deal with SWD. Surveys were conducted to extension educators from Univ. of Missouri and Lincoln University nine months after they took a In-Service Education (training) workshop on SWD in November, 2013, indicated that they used the information they learned and they were able to reach 614 farmers. **Please see Appendix I with a full report derived from this ISE workshop on SWD, documenting mid-term impacts.**

One educator from Univ. of Missouri Extension implemented an SWD workshop on her own, and implemented a 6-month post-workshop survey. Information obtained confirms that farmers changed behaviors (a mid-term outcome) by implementing IPM approaches to manage SWD. For example, 100% of participants set out the SWD monitoring traps, 25% of the participants made additional SWD traps to place in their crops, 50% of the participants monitored the SWD traps after 2 weeks of placing them in the fields, 25% managed the canopy of the fruit, 25% trellised the cane fruits, 50% removed bad and overripe fruit instead of leaving them on the plants, 25% disposed of bad and overripe fruit by sealing in a plastic bag and throwing it away, 25% of the participants used chemicals and rotated them during the season to control the SWD. **Very importantly 50% of the participants were able to save their small fruit crop this year using techniques learned at the workshop with having about the same edible fruit as the previous year.**

OUTCOMES AND IMPACTS FROM OUR EXTENSION (OUTREACH): Over a 3-year period at least 6,500 people (a conservative estimate; precise numbers are very difficult to estimate given that mass media was used sometimes to disseminate the information, and also posters have been presented and professional and growers conferences were potentially thousands of people may have seen the posters) received information generated by this project. Farmers that attended the SWD workshops reported an increase in knowledge concerning identification and management options for this invasive insect pest.

Some of the output indicators were:

- Number of workshops: 25
- Number of field days: 6
- Number of farmers visited the research sites in Jefferson City
    - Carver Farm: 445 combining 2013, 2014, and 2015)
    - Busby farm: 327 (combining 2013, 2014, and 2015)
- Number of publications (fact sheets): 4
- Website (blog) on SWD and BMSB: 1
- Number of presentations (oral / poster) (2013-2015): 16 (see breakdown below)

- Great Plains Growers Conference (2013-2015): 7
- Missouri Organic Association: (2013-2015): 1
- Midwest Organic Sustainable Education Service (MOSES) (2013-2014): 3
- Other: 5

Measurable outcomes to growers included:

- Number of farmers participated in field days and workshops: 1,560
- Number of readers of 7 articles by J. Piñero posted in the University of Missouri IPM website: 4,645
- Knowledge gain by farmers on SWD identification and management: *documented with pre- and post-workshop surveys*
- Implementation of monitoring systems for SWD: At least 25 farmers
- Adoption of at least IPM strategies to manage SWD: At least 10 farmers
- Adoption of mass trapping as an organic management strategy for Japanese beetles: At least 10 farmers.

Information included in the present report shows that the above expectations were met and even surpassed. By requesting a no-cost extension until July 31, 2015, we were able to conduct additional monitoring and outreach thereby more farmers received the information that this project generated.

Beneficiaries

We do not have access to information that indicates how many people grow berries or other crops that are susceptible to SWD, Japanese beetle and BMSB in Missouri either, commercially or in home gardens. However, assuming that people who attended our workshops and field days (who were very interested in learning about SWD, Japanese beetle, and BMSB and made the effort to drive to the workshop / field day locations) produced fruits or vegetables susceptible to any of these invasive pests, then a conservative estimate is 1,500. This number does not include readership of our Newsletter articles or press releases.

Lessons Learned

Monitoring for invasive insects needs to be implemented using as many means as possible in order to have early warning systems in place. The Lincoln University IPM program is understaffed and therefore is unable to deploy a state-wide monitoring system. Time required for one person to drive to farms to inspect and service monitoring traps was underestimated, and additional salary funds had to be provided.

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Additional Information

Fact Sheets / Guide Sheets listed above are available at

http://www.lincolnu.edu/web/programs-and-projects/ipm

Any other document is available upon request (pineroj@lincolnu.edu)

APPENDIX I

Results of an online 9-month post-workshop survey on SWD that was applied to extension educators / agriculture professionals / agency partners. Important mid-term outcomes (impact) were recorded.

Workshop held on November 20th, 2013 in Columbia, MO

WORKSHOP GOAL: To train agricultural professionals and Extension educators on identification, biology, monitoring, and most effective management methods for the invasive Spotted Wing Drosophila so that they are better able to assist farmers.

EVALUATION TOOL: Web-based 11-month post-workshop survey conducted on **October 5th, 2014**, to 42 Extension educators that took the ISE workshop

Table below presents (1) the number of Extension educators (by Institution) that took the training and were sent the online-based 11-month post-workshop survey, (2) the number of educators that responded to the survey, and (3) response rates.

Institution	Number that attended workshop	Number that responded to survey	Response rate
Univ. Missouri Extension	15	8	53.3%
Lincoln Univ. Cooperative Extension	15	10	66.7%
MO Dept. of Conservation	4	2	50%
MO Dept. Agriculture	8	4	50%
TOTAL	**42**	**24**	**57.1%**

Table below presents the proportion of Educators that indicated ways in which the information provided actually helped them with their Extension work:

The information I learned helped me to:	% of responders
Answer client questions (21/24)	88.0%
Incorporate new ideas and information into regular programming (10/24)	41.7%
Develop special programming on the overall topic of IPM (4/24)	16.7%
Write articles for newsletters and/or newspaper columns/radio shows using IPM information (8/24)	33.3%
Other (workshops, Master Gardener presentations, were listed) (5/24)	20.8%

Actual names of special programming conducted that included new IPM information on SWD are:

- ✓ Central MO farm tour
- ✓ Master Gardener presentations
- ✓ SWD emerging issue
- ✓ Lady Landowner workshops
- ✓ Food Safety workshop
- ✓ FYI session at Putnam County Fair
- ✓ Spring Forward Into Gardening Workshop
- ✓ New Invasive Pest
- ✓ SWD management
- ✓ New and upcoming pests of fruit and vegetables

Actual number of clients assisted: 614 (by the 24 Educators that filled out the 11-month post-workshop survey). This outcome exemplifies the multiplicative effect of this type of workshops: on average, each of the 24 educators that replied to the survey was able to reach, on average, 25 farmers using information that they received at this workshop.

Actual number of Newsletter articles, newspaper columns/radio shows: 31

Proportion of Educators that used information for farm visits and/or one-on-one interactions and provided advice on IPM (21/24): 88.0%

Actual number of farms visited since SWD training: 243

Actual number of one-on-one interactions with farmers: 136

Percentage of educators (that responded to the survey) that interacted with minority/limited-resource farmers (10/24): 41.7%

Actual number of minority and/or limited-resource farmers Educators interacted with: 92

In this particular survey we wanted to get some economic data by asking educators this question: *"Do you believe MO berry / tree fruit farmers experienced reduced economic losses due to SWD infestations in 2014 compared to 2013, thanks to your advice?"* Thirty-percent of the educators indicated that they believe their advice resulted in less economic losses for farmers whereas 15% indicated that they don't believe their advice resulted in reduced losses compared to 2014. The remainder, 55%, responded "I don't know".

Table below shows the educator's responses to the question "*Please indicate what your overall experience with SWD was in 2014 compared to 2013*". It shows that educators were very active addressing SWD issues with farmers, and therefore the overall objective of this workshop was met successfully.

I didn't help any berry / tree fruit grower during the 2014 growing season	**4**	16.77%
I received less phone calls / requests about SWD infestations than in 2013	**7**	29.2%
I received about the same number of phone calls / requests about SWD infestations as in 2013,	**5**	20.8%
I received more phone calls / requests about SWD infestations compared to 2013	**8**	33.3%

Additional comments provided in the online survey:

It seemed SWD was less troublesome this year than expected. This may have been in part because blackberries received winter injury, thus there were less wild blackberries.
I contacted a berry grower who has a nursery license to sell perennials in the state of Missouri. He was not aware of SWD and I gave him some information.
I helped three clients set up traps on their farms and taught them how to monitor them and identify SWD. The problem came when they found the fly and said "now what?" The only solution I had was to suggest they sell their berries frozen (not fresh) and to look for signs of them in cracked tomatoes.
I think it is possible the reason inquiries increased in 2014 over 2013 for me is some areas in my coverage region first found the larvae in 2014.
Fruit and berry farmers in the St Louis city seem not to have issues with the SWD, or rather they are non- commercial, novice growers who may think that the damage is just part of the protocol for growing fruit.
I generally report any new finds of SWD in my survey traps to the National Agricultural Pest Information System (NAPIS). In 2013 I found several new county records and reported them to this database and I have recently found another new county record and will report it in 2014. I also report the findings in pest meetings I attend and also put positive find information in report to survey cooperators.
The information provided at the workshop was VERY valuable. It helped me to help growers who may have SWD infestations in the future.
Not directly worked with growers who have SWD concerns, but have a feeling that the educational programs by the Lincoln IPM team greatly helped in raising awareness and improved the level of preparedness for this invasive pest.
Producers I worked with set out traps after learning about them during programs I conducted. I think this helped them monitor for SWD. The workshop was extremely helpful to me. I took what I learned and passed it on to the producers I work with.
Thanks again for the excellent workshop.
Great workshop and materials that were presented although it was the most depressing workshop that i have ever participated in due to the seriousness of the situation and implications for future management options.
My trap never caught any but I had a few in my late blueberries before I sprayed. I sprayed my elderberries 4 times and I don't think I had any damage.
I helped three clients set up traps on their farms and taught them how to monitor them and identify SWD. The problem came when they found the fly and said "now what?" The only solution I had was to suggest they sell their berries frozen (not fresh) and to look for signs of them in cracked tomatoes.
Fruit and berry farmers in the St Louis city seem not to have issues with the SWD, or rather they are non-commercial, novice growers who may think that the damage is just part of the protocol for growing fruit.

Building IPM capacity in Missouri through train-the-trainer workshops and effective partnerships

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ABSTRACT From 2011 to 2013 the Lincoln University (LU) IPM Program partnered with the Missouri Sustainable Agriculture Research and Education (SARE) program and implemented four train-the-trainer workshops. One important workshop was on the invasive insect Spotted Wing Drosophila. Overall, subject matter experts from nine US states provided training to 153 Extension educators from Univ. of Missouri Extension, LU Cooperative Extension, USDA Natural Resources and Conservation Service (NRCS), Missouri Department of Agriculture, Missouri Department of Conservation, University of Illinois Extension, and University of Nebraska Extension. Educators indicated that they significantly increased their IPM knowledge leading to improved abilities to assist farmers. The implementation of these 2-day workshops also resulted in important mid-term outcomes. For example, results from 9-month post-workshop surveys indicated that: (1) 2,453 farmers were assisted by the 83 trainees that answered the survey sing IPM information received at the workshops, (2) 26.5% of the respondents wrote articles for newsletters and/or newspaper columns using IPM information (131 total outputs), and (3) 86.7% of the respondents visited 595 farms and used IPM information. Overall, the implementation of this type of Extension IPM activities has proven successful, and the outcomes highlight the efforts that the LU IPM program is taking to train Extension educators in necessary IPM skills including invasive insects within and outside Missouri.

INTRODUCTION

Integrated Pest Management (IPM) proponents and practitioners share interests in promoting and improving environmental quality, farm economic viability, sustainable agriculture, and soil and human health. In Missouri there is a high need to bring research-based information on all aspects of IPM to the state's citizens. The Lincoln University (LU) IPM Program was established in April, 2010, in response to that need. LU is an 1890- land-grant University located in Jefferson City, Missouri.

One of the key features of the LU IPM program is the ability of its staff to conduct farm visits throughout the state. This allows us to provide on-site advice on pest identification, prevention, monitoring, and suppression methods, thus providing farmers with a timely response to their IPM needs. In addition to working with vegetable and small fruit farmers, this program has implemented annual 'train-the-trainer' workshops targeting extension educators and agriculture service providers. Reported here is a summary of activities and outcomes derived from four In-Service Education (ISE) workshops conducted from 2011 to 2013.

OBJECTIVE

The main goal of the ISE workshops was to provide training to agricultural professionals and educators in the Missouri's Cooperative Extension Service on the most up-to-date information on sustainable IPM in various cropping systems.

APPROACH

Four workshops were offered by the LU IPM program from 2011 to 2013 (Table 1).

- ✓ After review, the MO SARE formally approved requests to conduct the IPM workshops as part of the Missouri SARE plan of work for each year.
- ✓ Univ. of Missouri (MU) partnered and provided logistical support the LU IPM program carried out the workshops (Fig 1).
- ✓ The selection of topics that were presented at each workshop was based on surveys that were implemented via online as well as direct input provided by MU / LU Extension personnel.
- ✓ Trainers were chosen based on area of expertise and geographical location.
- ✓ Each workshop had about 14 hours of effective training time.

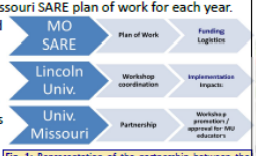

Fig. 1: Representation of the partnership between the Missouri SARE program, Univ. of Missouri and Lincoln University (a 1890 land-grant university) that led to the successful implementation of four IPM workshops that targeted Extension educators and Agriculture Service Providers from 2011 to 2013.

For each workshop, the following short- and mid-term outcomes were expected:

- ✓ Educators would increase their knowledge and awareness of the economic and environmental benefits of implementing IPM in various cropping systems in Missouri .
- ✓ As a result of the training workshops, Extension specialists would be able to make informed IPM recommendations.
- ✓ At least 10 educators would organize workshops with IPM or invasive insects such as Spotted wing Drosophila as central topic.
- ✓ All educators would improve their ability to assist farmers on effective ways of managing insect pests, weeds, and diseases.
- ✓ **EVALUATION:** Shor-term outcomes were documented via a pre- / post-workshop survey. Mid-term outcomes were recorded through an online-based 9-month post-workshop survey. Additional input was requested.
- ✓ Combining all four ISE workshops, 153 Extension educators and Agriculture Service Providers received training on IPM. Of these, 34.6% were from MU Extension, 39.2% from LU Cooperative Extension, 6.5% from MDA, 2.6% from MDC, 14.4% from NRCS, and 2.6% represented other institutions.

	No. OF TRAINEES							
Workshop (year)	Univ. Missouri (MU)	Lincoln Univ. (LU)	Mo Dept. Agric. (MDA)	MO. Dept. Conservation (MDC)	USDA NRCS	Other	SUM	TRAINERS
Vegetable IPM (2011)	12	15	0	0	15	1[a]	43	Kansas State Univ., Purdue, USDA-ARS, IPM Institute, Univ. Arkansas, Univ. Illinois, MU, LU
Small fruit IPM (2012)	10	13	1	0	2	0	26	Michigan State Univ., The Ohio State Univ., MU, LU
Sust. Mgmt. Soil-borne Diseases and Weeds (2013)	16	17	1	0	5	3[b]	42	Kansas State Univ., Western Illinois Univ., The Ohio State Univ., MU, LU
Spotted Wing Drosophila (2013)	15	15	8	4	0	0	42	Michigan State Univ., MU, LU

[a]Jefferson Institute (Columbia, MO). [b]Univ. of Illinois Extension (2), Univ. of Nebraska-Lincoln (1)

Table 1. Topics of the four ISE workshops on IPM held in Missouri (2011-2013), attendance and affiliation of the trainers who participated in the workshops.

SHORT-TERM OUTCOMES: For each of the 30 IPM topics that were taught over a 3-year period, significant increases in knowledge were documented. As an example, Table 2 presents the results from the pre- and post-workshop survey reflecting increases in knowledge for one of the workshops.

Short-Term Outcomes

Scores used in the on-site evaluations:
1 = No knowledge / 2 = Little knowledge / 3 = Moderate knowledge / 4 = Very knowledgeable

TOPIC	MEAN SCORE BEFORE	MEAN SCORE AFTER	P-value	% INCREASE IN KNOWLEDGE
Diagnosis of key soil-borne diseases affecting fruits and vegetables (Dr. Mueller)	2.0	3.0	< 0.001	84%
Vegetable grafting as an IPM strategy against soil-borne diseases (Dr. Rivard)	3.0	4.0	< 0.001	80%
Management of soil-borne diseases in organic vegetable production (Dr. Rivard-Cond.)	2.0	3.0	< 0.001	84%
When weeds are the vampy crops lose 25% annually	3.0	4.0	< 0.001	84%
Bacillus as biofungicide and tuned suppressant cover crops (Dr. Kluepfel)	2.2	3.7	< 0.001	100%

A t-test of the 0.05 denotes a statistically significant difference between the mean score values recorded before and after the training. Also a significant increase in knowledge

Table 2. Increases in knowledge of Extension educators that attended the 2013 ISE workshop on 'sustainable management of soil-borne diseases and weeds', as documented by pre-and post-workshop surveys

MID-TERM OUTCOMES: Results from the 9-month post-workshop surveys revealed that Extension educators in Missouri improved their abilities to assist farmers as a direct result of the IPM workshops. Table 3 presents some ways in which the information presented at the workshops were used by the trainees (mid-term outcomes).

	% OF RESPONDERS			
The information I learned helped me to:	Vegetable IPM (2011)	Small Fruit IPM (2012)	Sust. Mgmt. Soil-borne Diseases and Weeds (2013)	Spotted Wing Drosophila (2013)
Answer client questions	78%	92.9%	87.0%	88.0%
Incorporate new ideas and information into regular programming	56.5%	64.3%	66.2%	41.7%
Develop special programming on the overall topic of IPM	15.3%	14.3%	17.4%	16.7%
Write articles for newsletters and/or newspaper columns/ radio shows using IPM information	40.5%	7.2%	39.1%	33.3%

Table 3. Proportion of responders that indicated how they applied the information gained at the IPM workshops within a 9-month period following the implementation of the workshops.

The multiplicative effect of the workshops is presented in Table 4. It shows that the 83 Extension educators that responded to the 9-month post-workshop survey reached 2,453 farmers within the 9-month period that followed workshop implementation. They also were able to reach 482 minority and limited-resource farmers.

The information I learned helped me to:	Vegetable IPM (2011)	Small Fruit IPM (2012)	Sust. Mgmt. Soil-borne Diseases and Weeds (2013)	Spotted Wing Drosophila (2013)	TOTAL (OR AVERAGE)
Actual number of clients assisted	779	237	823	614	∑= 2,453
Actual number of Newsletter articles, newspaper columns/radio shows	40	19	41	31	∑= 131
Proportion of Educators that provided advice on IPM at farm visits and/or one-on-one interactions	79%	92.9%	87%	88%	∑= 86.7%
Actual number of farms visited since IPM training	125	104	123	243	∑= 595
Actual number of one-on-one interactions with farmers	244	156	230	136	∑= 766
Percentage of educators that interacted with minority/limited-resource farmers	68.2%	71.4%%	69.6%	41.7%	∑= 62.7%
Actual number of minority and/or limited-resource farmers that were assisted	192	106	92	92	∑= 482

Table 4. Additional mid-term outcomes documented from the implementation of four ISE IPM workshops in Missouri

CONCLUSIONS

The implementation of this type of Extension IPM activities has proven successful, and the outcomes highlight the efforts that the LU IPM program is taking to train Extension educators within and outside Missouri in necessary IPM skills. Partnerships with the Missouri SARE program and with the Univ. of Missouri have resulted in important synergisms that have benefited farmers.

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Detecting Spotted Wing Drosophila (SWD) Larval Infestations in Fruit

with Notes on Insecticidal Options

Monitoring is Your First Step

The most important step in managing SWD is to determine whether they are present in your fields, and when adult SWD may become active.

Female Spotted Wing Drosophila

Photo by Tim Baker, MU Extension

LINCOLN University

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The Spotted Wing Drosophila (SWD), *Drosophila suzukii*, is a serious new invasive pest. It attacks small fruit crops, some stone fruits (cherry, nectarine, peach), high tunnel tomatoes and wild hosts (including pokeweed, autumn olive, crabapple, nightshade, Amur honeysuckle and wild grape). Raspberries, blackberries, blueberries and grapes are at the greatest risk. SWD flies look similar to the small vinegar flies that are typically found around or on fermenting fruits and vegetables. However, unlike native vinegar flies, the SWD females have a serrated egg-laying device (ovipositor) to cut a slit into the skin of intact fruit to lay their eggs. This makes the SWD a more significant pest. An identification and monitoring fact sheet, FS-18-A-2013, has been developed by the Lincoln University Cooperative Extension (LUCE) Integrated Pest Management (IPM) program. It is available at: http://www.lincolnu.edu/web/programs-and-projects/ipm.

This guide sheet discusses how to detect larval infestations and how to manage the SWD based on the key IPM components listed below.

An SWD control program starts with monitoring. If the SWD is detected, chemical control is needed to keep fruit marketable. For commercial growers, some chemicals already used in your IPM program for similar pests should effectively control the SWD.

Blackberry fruit with SWD larvae on the surface. The brown, sunken areas of the fruit are caused by SWD larvae feeding, and secondary fungal and bacterial infections.

1. Monitor fields with traps, and check them regularly.
2. Check trapped flies to reveal the presence and number of the SWD.
3. If the SWD is found and fruit are ripening or ripe, apply effective insecticides registered for that crop to protect the fruit until harvest is done.
4. Continue monitoring to evaluate your management program. Now, check traps twice per week, and respond quickly if needed.
5. Use cultural controls where possible to reduce SWD food resources.
6. Stay informed. These guidelines are subject to change based upon new information.

Detecting Larval Infestations in Fruit

The following recommendations are largely based on guidelines provided by Michigan State University (MSU) and Oregon State University (OSU).

A first sign of SWD infestation in raspberries might be red patches left on the container as berries are picked. The fruit of raspberries and blackberries might also begin to collapse in areas where the larvae are feeding inside. Opening the berries might reveal the larvae within the fruit, but it is time consuming to check each berry. Fruit can be selected in two ways: either collect fruit at random or collect only fruit suspected to be infested (i.e., based on the presence of oviposition scars and/or soft spots on the fruit).

Two methods of SWD Detection

(1) Sugar-water method: Place fruit in a plastic Ziploc® bag; crush lightly to break the skin. Then add a sugar-water mixture (one-fourth cup sugar to four cups water). The SWD larvae will float in the liquid, and the fruit will sink. Detection of small larvae might require the use of a hand lens. This works well with a light behind the bag to create backlighting.

Salt water irritates the larvae and causes them to wiggle out of the fruit.

(2) Salt-water method: A salt solution will irritate the larvae, causing them to wiggle out of the fruit. To prepare a salt-water solution, dissolve one-fourth cup plain salt in four cups warm water. Place fruit in a shallow white pan; cover with salt solution. Observe the fruit closely for at least 10-15 minutes to see larvae exiting the fruit from the egg-laying holes. Detection of small larvae might require the use of a hand lens and good lighting. This simple fruit sampling evaluates the effectiveness of pest control actions. It also helps to minimize the amount of SWD-infested fruit that would otherwise be marketed.

Insecticidal Control

Because this pest is so new to Missouri, there has been no research on insecticidal treatments to manage the SWD. Recommendations are based on findings from other states. Before you spray, confirm that you have the SWD in your area by hanging out traps or checking fruit. Sprays must be timed to kill adults before they lay eggs; sprays will not control larvae already in the fruit. Always read product labels to make sure pesticides are registered for use on the fruit or berry you are treating.

If monitoring indicates a need to spray, the application should be made about two to three weeks before berry harvest. Depending on the residual effectiveness of the insecticide, a second application might be needed five to 10 days later. In the case of indeterminate fruiting berries

Use of effective insecticides that are well timed and have good coverage can keep the SWD controlled through harvest. However, given the potential for rapid population increase by the SWD, especially during fall red raspberry season, active management through monitoring of flies and fruit infestation is critical.

Always follow the specific label restrictions for raspberry/blackberry crops. The level of control achieved will depend on the SWD population, timeliness of application, coverage of fruit and product effectiveness.

(those that continue to produce fruit), such as raspberries or strawberries, sprays might need to be repeated to keep populations low during summer and fall. You can use monitoring traps to help you decide if and when extra spraying might be needed. Be sure to wait the interval specified on the pesticide label before harvesting fruit. Thus far, an economic threshold for SWD has not been developed. MSU recommends a conservative approach: fly capture on your farm triggers protection of fields if berries are at a susceptible stage.

For commercial small fruit farmers – conventional method: A number of registered insecticides have been very effective against the SWD in laboratory trials, including some recent trials done at MSU. The most effective chemicals are organophosphates, pyrethroid and spinosyn (a large group of compounds produced from the fermentation of two species of soil-inhabiting rod-shaped bacteria) classes of insecticides. Under field conditions, insecticides with fast knockdown activity have performed well at protecting fruit and berries from the SWD. These include malathion, which is an organophosphate insecticide; the pyrethroids Danitol®, Mustang Max™ and Brigade®; and the spinosyns, Delegate® (spinetoram, a mixture of chemically modified spynosins) and Entrust® (organic). Delegate® 25WG and Radiant® SC are reduced-risk, broad-spectrum insecticides that have been labeled for control of the SWD in various crops in all states. Both products maintain most populations of beneficial insects. They also do not flare mites and have short re-entry (four hours) and pre-harvest (e.g., one day for Radiant® on strawberries) intervals. Based on information from MSU, neonicotinoids, such as Provado® and Actara®, are considered weakly active on SWD flies; they are not recommended for control.

For commercial small fruit farmers – organic method: In bioassays conducted by MSU with Azera® and Pyganic®, these options performed less effectively than Entrust®. However, pyrethrum class insecticides can still be a valuable tool for organic growers because the Entrust® label requires rotation to another product for resistance management. Pyganic® or Azera® can very well fit that need. Entrust® is the only organic product with residual activ-

How to make a monitoring trap for SWD

ity (five- to seven-day control). While it does not appear to provide residual control, Pyganic® applied at five-day intervals at the high labeled rate has shown to reduce the SWD populations in California. Organic growers in the Pacific Northwest have used two to three applications of Entrust® (spinosad) effectively to protect fruit in the pre-harvest period alternately with Pyganic® (pyrethrum). This extends the period of control and also reduces the chance of developing resistance.

For homeowners: The insecticide spinosad (e.g., Monterey Garden Insect Spray) is effective and has the least negative environmental effects of currently available products. Some spinosad products are sold to be applied with a hose-end sprayer, but a compressed-air sprayer will give more reliable coverage. Fertilome® Borer, Bagworm, Tent Caterpillar & Leafminer Spray (spinosad 0.5%) and Green Light® (spinosad 0.5%) are also labeled for use in bushberries and caneberries against fruit flies. The organophosphate insecticide malathion is widely available and will also control the SWD. However, malathion is very toxic to bees and natural enemies of other pests in the garden; care must be taken to keep the application on the target plant and avoid drift and runoff. Improper application also can result in injury to cherry trees. Because of the potential negative impact of malathion in the garden, use it only where you are certain you will have an SWD infestation; this is either because you had a problem last year or after you have trapped and positively identified insects this season as the SWD.

Please refer to the LUCE IPM guide sheet GS-18-D-2013 "Management of Spotted Wing Drosophila with Emphasis on High Tunnel-grown, Fall-bearing Primocane Raspberries" and to the "2014 Midwest Small Fruit and Grape Spray Guide" available for free at https://ag.purdue.edu/hla/Hort/Documents/ID-169.pdf ■

SWD on raspberry fruit. *Photo by Tim Baker, MU Extension*

Important Notes About Pesticides

- Registrations and recommendations change, so keep informed through SWD websites and your local Extension educator.
- For all pesticides, consider re-entry intervals (REIs), pre-harvest intervals (PHIs), surface water and buffers, and safety to pollinators and other beneficial arthropods (insects/spiders) when selecting a product.
- Remember to rotate classes of insecticides to delay possible development of insecticide resistance.
- To address pollinator safety, make early morning or late evening applications of all products.
- As with all uses of insecticide to control pest insects, the label is the legal document that provides the official guidance on the appropriate use pattern.
- Refer to the label and any supplemental labels for the full restrictions on use in your crop. A good place to locate all the most up-to-date information is through the CDMS website: http://www.cdms.net/labelsmsds/LMDefault.aspx. If new supplemental labels are developed allowing expanded uses for SWD control, those will be posted at this site. ■

No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

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Project 10: The Kansas City Beans&Greens Mobile Market Program

The Menorah Legacy Foundation
Gayla Brockman
Final Performance Report

Project Summary

In the article "Opportunities to Reduce Childhood Hunger and Obesity - Restructuring the Supplemental Nutrition Assistance Program (the Food Stamp Program)" David S. Ludwig, MD, PhD, Susan J. Blumenthal, MD, MPA and Walter C. Willett, MD, DrPH, discuss the importance of good nutrition on optimal physical development and how many children from low-income families receiving Supplemental Nutrition Assistance Program (SNAP) benefits do not consume adequate amounts of nutritious foods.[1] The highest rates of obesity are found in people with the lowest incomes. Among poor populations, 7 times as many children are obese as are underweight.[2] The causes of this are many. Low-income families are challenged in having dependable access to affordable, high-quality food. Low-income families often live in neighborhoods lacking full-service grocery stores. Fresh produce, if available, is more expensive and often of poorer quality in low-income neighborhoods. Traveling to better markets is expensive and often difficult. Additionally, families with limited financial resources may experience long-term, cyclical variation in food availability, with overconsumption at the beginning of the month after distribution of SNAP benefits followed by deprivation at the end of the month when benefits have been exhausted. At the same time, low-income families often try to stretch their food budgets by purchasing cheap, high-calorie foods that are filling but nutritionally low-quality. SNAP benefits can be used to purchase any food or beverage, except alcohol, tobacco, vitamins, and hot prepared items. Recent data indicate that, among low-income adults, SNAP participants have lower dietary quality than nonparticipants.[3] The public pays for sugary drinks, candy, and other junk foods included in SNAP benefits twice: once at the time of purchase, and later for the treatment of diet-induced disease through Medicaid and Medicare.[4] Obesity remains one of the leading causes of preventable death and illness in Kansas and Missouri. The obesity rates for Kansas and Missouri are 29.8% in Kansas and 29.6% in Missouri according to the 2013 America's Health Rankings report.

According to the USDA Economic Research Service Food Environment Atlas, the number of Americans using SNAP continues to rise from 40.3 million in 2010, to 44.7 million in 2011 to 46.6 million in 2012. Locally, SNAP participation rose from 15.7% in 2011 to 18% in 2012 in Jackson County, Missouri and from 10.41% in 2011 to 22% in 2012 in Wyandotte County, Kansas.

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[1] 1. Ludwig DS, Blumenthal SJ, Willett WC Opportunities to Reduce Childhood Hunger and Obesity. *JAMA,* December 26, 2012 – Vol. 308, No. 24.

[2] Coleman-Jensen A, NordM, Andrews M, Carlson S. Household Food Security in the United States in 2011. Washington, DC; US Dept. of Agriculture; September 2012. Economic Research Service Report ERR-141. http://www.ers.usda.gov/media/884525/err141.pdf. Accessed December 3, 2012.

[3] Polhemus B, Dalenius K, Mackintosh H, Smith B, Grimmer-Strawn L. *Pediatric Nutrition Surveillance 2009 Report.* Atlanta, GA: US Dept of Health & Human Services, Centers for Disease Control and Prevention; 2011.

[4] Ludwig DS, Blumenthal SJ, Willett WC Opportunities to Reduce Childhood Hunger and Obesity. *JAMA*. December 26, 2012-Vol. 308, No. 24

SNAP provides America's low-income population with resources to purchase food in an effort to alleviate hunger and improve nutritional status. In the 2012 report, A Fresh Approach to Strengthening the Supplemental Nutrition Assistance Program, from the Washington DC Center for the Study of the Presidency and Congress, the authors' site ten evidence-based strategies for improving nutrition for SNAP participants. These include the following:

1) Protect current funding levels for SNAP.
2) Collect data on SNAP purchases.
3) Identify a set of integrated strategies that would help align SNAP purchases with the 2010 Dietary Guidelines for Americans.
4) Focus attention on children's health in SNAP.
5) Use incentives to make fruits, vegetable, and whole grains the easy choice.
6) Establish stronger food stocking standards for SNAP retailers.
7) Provide states with flexibility to evaluate fresh approaches to SNAP.
8) Promote innovation in SNAP.
9) Create a partnership to move SNAP towards health.
10) Establish a national strategy of fresh approaches to strengthen SNAP.[5]

The Kansas City Beans&Greens Program is addressing eight of the ten strategies through its innovative incentives, supportive program design, nutrition education and cooking demonstrations and community and state mobilization activities.

In 2010, the Menorah Legacy Foundation launched the Kansas City Beans&Greens Program to address the lack of access and lack of affordability of fresh, nutrient-rich foods in low-income neighborhoods. Beans&Greens matches food assistance benefits - such as Supplemental Nutrition Assistance Program (SNAP), Supplemental Security Income (SSI) and Senior Farmers Market Nutrition Program (SFMNP) - dollar-for-dollar at twenty (20) participating farmers' markets in Jackson and Clay Counties in Missouri and Douglas, Johnson and Wyandotte Counties in Kansas. The participating markets are provided with the technology to accept the food assistance debit card, program support for staffing and administration and nutrition education and cooking demonstrations. In 2011, the Beans&Greens launched the Mobile Market Program to reduce the barrier of access to fresh, specialty crop produce to low-income, food desert communities. By bringing the market to these communities, and using the Cooking Corps to teach them about healthy eating and cooking, we are increasing the likelihood that buying fresh, healthy produce is the easy choice and one with which they can make into a regular, weekly habit.

Of the 26 farmers markets and mobile market sites participating in the Beans&Greens program, 19 sell only fruits and vegetables. Therefore, the majority of our sales tracking numbers are reflecting sales of fresh fruits and vegetables.

Each year the Beans&Greens staff conducts customer surveys. Each year our returning customers as compared to new customers consistently indicate the following reasons for returning to the Beans&Greens participating farmers markets:

Customers reported higher mean scores for questions regarding:

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[5] Blumenthal SJ, Hoffnagle E, Willet W, et al *SNAP to Health: A Fresh Approach to Strengthening the Supplemental Nutrition Assistance Program.* 2012 Washing ton DC: Center for the Study of the Presidency and Congress; July 2012. http://www.thepresidency.org/storage/documents/CSPC_SNAP_Report.pdf.

- enjoyment of fruits and vegetables
- child enjoyment of fruits and vegetables
- knowledge of preparation techniques for fruits and vegetables
- knowledge that fruits and vegetables are beneficial for one's health
- affordability of fruits and vegetables

Customers already reported that their average weekly intake of fruits and vegetables was **higher** for repeat Beans&Greens users.

In addition, Beans&Greens is able to track SNAP reimbursements by individual farmer at some of our markets. This data over time clearly demonstrates how Beans&Greens is important for specialty crops. In 2009, before Beans&Greens was launched, farmers who sell at the City Market in downtown Kansas City, Missouri began to accept the SNAP EBT card. That year **produce** farmers were reimbursed a total of $4,459.22 for SNAP purchases. In 2010, the KC Beans&Greens Program was launched and SNAP reimbursements for produce farmers increased to $35,748.14. In 2011, SNAP reimbursement for produce farmers increased to $65,618.16 and in 2012 SNAP reimbursements rose to $100,186.53. That is a dramatic rise in sales that occurred immediately with the launching of Beans&Greens and has continued since.

Additionally, farmers continue to ask us each year to survey our customers for their fruit and vegetable preferences so that they may attract SNAP customers to their stalls.

Project Approach

Project Activity	Who	Outcome
Assess previous season EBT sales and match data for all participating farmers markets and mobile market & survey data	Beans&Greens Program Manager, Mobile Market Manager, Beans&Greens partners, volunteers	Eliminate two stops: one at a housing project and one the health department. Add a stop in a high traffic neighborhood in Wyandotte County and at the Catholic Charities agency KC, KS office.
Schedule meetings with neighborhood partners to de-brief 2012 project, plan and adjust for 2013	Mobile Market Manager, Beans&Greens staff, neighborhood partners	Community members become engaged in the project and assist with site set-up and take-down, promotion and community outreach.
Debrief/Renew purchase agreements with farmer suppliers for 2013	Mobile Market Manager, local growers	Increased number of area farmers to regularly provide produce to the Mobile Market

Review previous season cooking demonstrations and schedule and determine schedule for 2013	Mobile Market Manager, University of Missouri and Kansas State Extension educators and volunteers	Expanded number of cooking demonstrations to farmers markets and mobile market sites from 17 to 36 visits impacting 7,000 customers throughout the season.
Commence marketing, outreach for 2013, including fliers to agencies, signs, social media, radio advertising, etc. Have all materials translated into Spanish	Mobile Market Coordinator, Beans&Greens staff and translator	Created large banners that were visible in all directions and used at all Mobile Market stops. Created ads for newspapers. Saw spike in sales when ads came out.
Commence weekly sales routes and analyze sales data	Mobile Market Coordinator, assistant, volunteers and Beans&Greens consultant	Sales remained flat for the 2013 season as compared to 2012.

Specialty Crop Block Grant Program funds were SOLELY used to purchase locally grown produce and sold in neighborhoods where SNAP customers lived or congregated.

Other Activities Planned and Performed

Update Food Desert map to target two more staff, neighborhoods for 2013:

- In 2013 we added a site in Wyandotte County, Kansas and altered and expanded market times for 2 Jackson County, MO sites – Operation Breakthrough and Guadalupe Cents - so that we could sell produce at times that were more convenient to those two neighborhoods/agency customers

Initiate meetings, selection of additional neighborhood routes in KCMO:

- Requests for mobile market sites were reviewed prior to setting up meetings. For a request to advance forward in the review process it must come with a dedicated volunteer or volunteers who will provide set up/take down, sales and promotional assistance. There were no viable requests for new sites in 2013 in KCMO that included dedicated volunteers.

Complete permits, licenses, insurance for 2013 operations:

- During the grant period we completed the annual truck inspection and registration, renewed the liability insurance policy, renewed the egg license and staff went through an annual workers compensation physical exam.
- Conduct resource allocation assessment to accommodate expansion and respond as needed.
- Conduct consumer surveys –
- Students were hired to conduct annual customer and farmer surveys at participating markets and at the mobile market sites. More details were provided in the Project Summary section.

Goals & Outcomes Achieved

Now entering its fifth year, the Kansas City Beans&Greens Program continues to expand access to fresh, healthy food and make it affordable in Wyandotte, Johnson and Douglas (new in 2014) Counties in Kansas and Clay and Jackson Counties in Missouri for low-income families. Since its inception in 2010, Beans&Greens:

1. Tracked over 25,000 SNAP recipients and 1,000 SFMNP participants who have shopped at Beans&Greens markets;
2. Brought seniors to Wyandotte and Johnson County Beans&Greens participating markets who live outside of the area as evidenced by the fact that in 2013, 2,500 Senior Farmer Market Coupons were issued in Wyandotte and Johnson counties but we redeemed 5,575 coupons;
3. Supported 200 local farmers;
4. Surveyed 180 Beans&Greens SNAP customers at participating markets and learned the following:
    a. 56% said they could not shop at farmers markets without the match;
    b. 63% reported annual income of $20,000 or less;
    c. Majority living with 4 persons, 2 of which are children living in an owned or rented house or apartment;
    d. 78% indicating low or very low food security;
    e. The majority of participants (63.9%) would prefer to buy **local foods** if cost was not an issue;
    f. 48.3% would prefer to buy organic;
    g. Survey participants learned how to prepare fresh produce via a range of resources, including easy recipes, cooking classes, market demonstrations, and websites;
    h. Self-reported average weekly intake of fruits and vegetables was **higher** for repeat Beans&Greens users for almost all categories; and
    i. Repeat users also reported higher mean scores for questions regarding enjoyment of fruits and vegetables, child enjoyment of fruits and vegetables, knowledge of preparation techniques for fruits and vegetables, knowledge that fruits and vegetables are beneficial for one's health and affordability of fruits and vegetables
5. Increased sales at participating farmers markets for each of the four years and provided nearly half a million dollars in matching funds overall which generated another $536,000 in federal assistance dollars at area farmers markets. Exhibit 1 shows sales at both the participating farmers markets and at the mobile market. Exhibit 2 shows mobile market sales only

Exhibit 1: Sales Breakdown at Mobile Market (2011-2013)

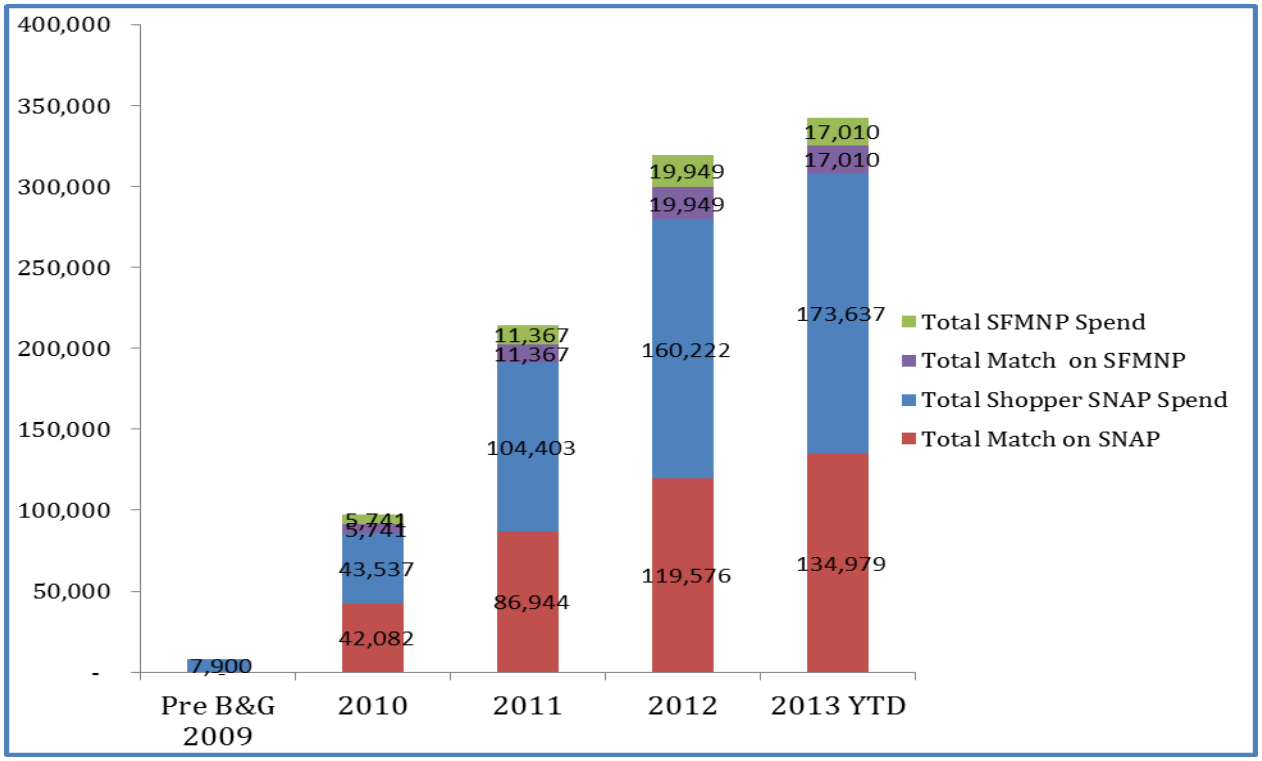


Exhibit 2: Sales Breakdown at Mobile Market (2011-2013)

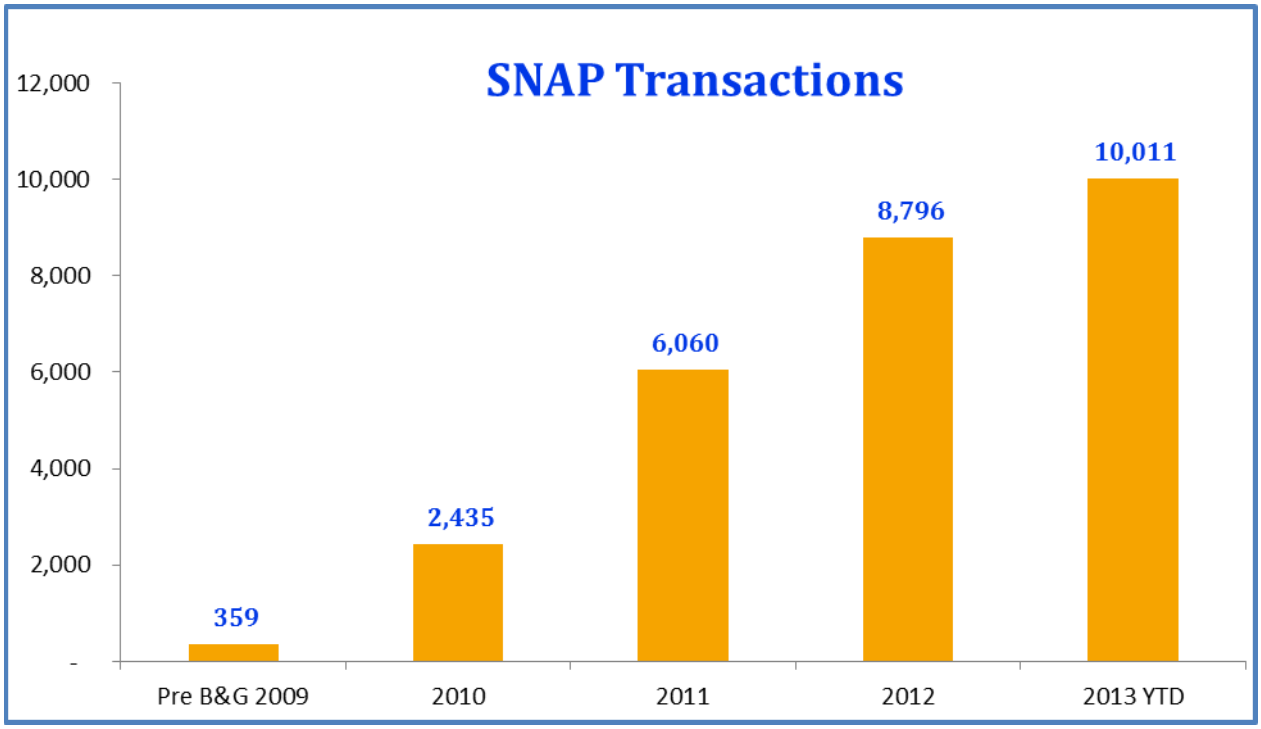
Food Assistance Spend	2011	2012	2013	Totals
Total Shopper SNAP Spend at Mobile Mrkt	4,451	4,474	4,524	13,449
Total Match on SNAP	199	418	458	1,075
Total SFMNP Spend	165	555	406	1,126
Total Match on SFMNP	165	555	406	1,126
Totals	**$ 4,980**	**$ 6,002**	**$5,794**	**$16,776**

Completion of the expected measureable outcomes indicated in our approved project proposal is provided below:

- Increasing access to healthy food in underserved areas and, at the same time, reducing the number of food deserts in Greater Kansas City by 20% each year.
    - A "Food Desert Map" completed by the Mid-America Regional Council, the KC Center for Urban Agriculture and Beans&Greens shows the locations of existing stores/markets relative to large populations of food stamp recipients and food deserts (areas marked in pink below).
    - The map is used to select neighborhoods to be served by the Beans&Greens Mobile Market. The Beans&Greens program is currently active in 26 locations, including 17 farmers markets and nine mobile market stops.
        - In 2013, the number of participating farmers markets and mobile market sites increased to 26 from 24 in the previous year. Markets in Liberty and North Kansas City, Missouri were added. One Mobile Market site in Kansas was added and we eliminated one mobile market site at the Health Department in Kansas City, Missouri.
- Increasing Sales at Area Farmers Markets by Persons receiving Supplemental Nutrition Assistance Program (SNAP) and Senior Farmers Market Nutrition Program (SFMNP) by 100% each year.
    - All participating markets and the Mobile Market must submit weekly a report showing SNAP sales, match dollars provided, the number of transactions and copies of the receipts provided for each Electronic Benefits Transfer (EBT) transactions in order to receive Beans&Greens Program Match reimbursement. Transactions are analyzed to capture data regarding the purchasing habits of food stamp recipients in order to determine the number of low-income persons served by the Program and whether it is serving its target population. Data collected includes: the unique 4-digit code on each SNAP card, the total EBT sales and match dollars, and the number of transactions each market day.
        - Exhibit 1 demonstrates how sales have increased over time for the entire Beans&Greens Program. However, in Exhibit 2, sales for the Mobile Market decreased.
- Increasing the number of SNAP or SFMNP customers at area farmers market and at the Mobile Market by 100% each year.
    - Transactions are analyzed to capture data regarding the purchasing habits of food stamp recipients in order to determine the number of low-income persons served by the Program and whether it is serving its target population.
    - Data collected includes: the unique 4-digit code on each SNAP card, the total EBT sales and match dollars, and the number of transactions each market day.

- Exhibit 3 below demonstrates the increase of SNAP customers shopping at Beans&Greens markets.

Exhibit 3: SNAP Transactions at Beans&Greens Market Grow 267%



- Increasing the demand for locally produced, healthy food by 25%.
    - Changes in shopping and eating habits were measured with the use of "Retrospective Tests" given to food stamp recipients, asking them to compare their shopping and eating habits before and after the availability of the Beans&Greens Mobile Market and the dollar-for-dollar match.
    - Respondents indicated that they increased their consumption of fruits and vegetables from 1.85 times a week to 2.5 times a week due to the Beans&Greens match. When asked how often they ate fast food, respondents indicated they decreased their consumption of fast food from 1.45 times a week to 1.2 times a week.
        - Beans&Greens is helping to increase demand for fresh fruits and vegetables is rate of SNAP dollars to matching funds spent at farmers markets. When Beans&Greens was first launched, it was nearly a 1:1 rate of SNAP dollars to matching funds. In the years since, SNAP dollar spending is increasing at a faster rate than match funds – no longer are SNAP customers coming to the markets to just get the match. More often they are choosing to spend more of their limited SNAP dollars to purchase fresh produce at our markets than is offered in match. This is clearly evident in Exhibit 1 above.

Beneficiaries

- 18% of the population or 120,448 persons enrolled in SNAP and living in Jackson County, MO;
- 10% of the population or 22,004 persons enrolled in SNAP and living in Clay County, MO;
- 22% of the population or 35,389 persons enrolled in SNAP and living in Wyandotte County, KS;
- 4% of the population or 22,851 persons enrolled in SNAP and living in Johnson County, KS;
- 8% of the population or 8,791 persons enrolled in SNAP and living in Douglas County, KS;
- The 2,500 seniors who receive Senior Farmers Markets Nutrition Program assistance in Kansas and reside in Johnson and Wyandotte counties;
- Local area growers and urban farmers.

Specialty crop stakeholders/groups that benefited from the completion of this project's objectives are as follows:

- 25,000 Persons receiving SNAP benefits who live in and around Jackson and Clay counties in Missouri and Wyandotte, Johnson and Douglas counties in Kansas

- 200 Farmers within a 500-mile radius who sold produce to our Mobile Market and at our participating farmers markets

Lessons Learned

1. After three years of operating the KC Beans&Greens Mobile Market with expenses that far exceeded revenues, we have decided to cease operations and sell off the program's assets. While the idea was good in concept, the implementation is impractical and unsustainable with a single vehicle and staff person. A mobile market attached to a food hub or large food distribution system that is able to negotiate reduced pricing due to volume would be a more economical way of distributing specialty crop produce to low income persons.
2. We learned that there was both a lack of knowledge and a low level of comfort with shopping for and preparing fresh fruits and vegetables by young, African-American low-income families. We presented this information to our steering committee and representatives from the University of Missouri and Kansas State Extension responded by creating the Cooking Corps Program, which trains volunteers to conduct cooking demonstrations, provide nutrition education and food safety at participating Beans&Greens markets. This initiative dramatically increased sales at many of our markets and customer surveys since that time show a marked improvement in knowledge and level of comfort with preparation.
3. Meet with officials to educate them about how the KC Beans&Greens Program is positively impacting the health of residents of the greater Kansas City community and the financial stability of area growers.

4. Continue to promote the consumption of specialty crops to low-income residents by providing a financial incentive when they use their food assistance dollars at participating farmers markets.
5. Continue to reach out to other nutrition incentive programs across the country to build relationships and identify ways to collaborate.

Contact Person

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Additional Information

On February 19, 2013 a fire destroyed the offices of the Menorah Legacy Foundation, the owner and operator of the Kansas City Beans&Greens Mobile Market. The past year has been filled with legal and insurance actions along with the business of rebuilding the office, its systems, data and its staff. We moved into new offices at the end of September. Our new address is 8900 State Line Road, Suite 450, Leawood, Kansas 66206.

On a positive note, the fire did not affect or delay the operations of the Kansas City Beans&Greens Mobile Market Program.

Project 11: Exploring the Genetic Resources of Norton Grape for Fungal Disease Resistance

Missouri State University
Dr. Chin-Feng Hwang
Final Performance Report

Project Summary

Genetic mechanisms of defense against pathogens and pests has been studied extensively in herbaceous annual plants, but is rarely explored in woody perennial plants because of the high degree of heterozygosity, the long juvenile period and the lack of genomic resources. Plants develop defense strategies not only in vegetative tissue, but also in fruit such as grape berries, thus ensuring the maturation and survival of viable seeds. *Vitis aestivalis*-derived 'Norton', the official grape of the State of Missouri, is grown in many US regions where *V. vinifera* (the European grape used for most wine- making worldwide) production requires extensive pesticide use for fungal disease management. Growers throughout the Midwest have observed Norton to be cold hardy and resistant to several fungal pathogens including powdery mildew, downy mildew and *Botrytis* bunch rot. Therefore, a need exists to breed for grapevines that would combine the superior wine quality of *V. vinifera* with the disease resistance and cold hardiness of Norton. Genetic analysis of the F_1 progeny from a cross between *V. aestivalis*-derived

"Norton" and *V. vinifera* "Cabernet Sauvignon" will provide an excellent opportunity to elucidate the underlying molecular mechanisms of berry disease resistance.

Specific Objectives:

1. Test >800 simple sequence repeat (SSR) markers for potential polymorphism on a
   small set of DNA including parents and 6 F_1 genotypes
2. Screen the whole population with identified polymorphic markers to develop the first Norton linkage map to lay a foundation for future Norton breeding program
3. Conduct segregation analysis of the populations for resistance against powdery mildew (*Erysiphe necator*) and downy mildew (*Plasmopara viticola*) and *Botrytis* bunch rot (*Botrytis cinerea*)
4. Evaluate the existing F_1 population for adaptability, productivity and winemaking quality as well as select appropriate plants for backcrosses

The genetics and genomics of Norton traits that are involved in resistance to the above-described three fungi diseases has not been fully explored or understood. The development of Norton-derived grape varieties will accelerate the discovery of alleles and genes that determine berry resistance to fungal diseases. Our breeding effort will be facilitated by the development of genetic markers that can simultaneously maintain the disease suppression qualities of Norton and the fruit and wine characters of *V. vinifera*. Developing cultivars with sustained resistance is extremely important in a woody perennial fruit crop with a productive life span of several decades. Our focus on controlling grapevine fungal diseases by developing varieties with durable resistance will significantly lessen the dependence by the U.S. grape industry on costly and environmentally harmful pesticides. The discovery of genetic factors (e.g., markers and resistance genes) that are linked with berry disease resistance and berry chemistry in grapevine may also benefit exploration of durable resistance to pathogens and pests in other woody perennial fruit crops such as blackberry, blueberry, apple, plum and peach.

Work Plan:

Project Activity	Who	Timeline
Identification of polymorphic markers using parents and 6 F_1 genotypes (techniques include DNA isolation, polymerase chair reaction (PCR), gel electrophoresis and DNA fragment analysis via capillary electrophoresis)	Dr. Chin-Feng Hwang, Li-Ling Chen, Surya Sapkota and Xu Chen	October 2012 – March, 2013
Genotyping the entire population with polymorphic markers for the construction of the Norton genetic linkage map using JoinMap 4.1 software	Dr. Chin-Feng Hwang, Li-Ling Chen, Surya Sapkota and Xu Chen	January 2013 – September 2013

Phenotyping powdery mildew, downy mildew and *Botrytis* bunch rot disease index in the laboratory, greenhouse and vineyard	Dr. Chin-Feng Hwang, Susanne Howard, Surya Sapkota, Xu Chen and field Crew	June 2013 – September, 2013
Evaluation the F_1 population for adaptability, productivity and winemaking quality as well as select appropriate plants for backcrosses	Dr. Chin-Feng Hwang, Susanne Howard, Surya Sapkota and Xu Chen	May 2013 – September, 2013

This was a new project starting from Oct. 2012 to Sep. 2013.

Project Approach

Norton Mapping Population and Phenotyping Data

Crosses between *V. aestivalis*-derived "Norton" and *V. vinifera* "Cabernet Sauvignon" were made in Mountain Grove, MO in 2005 and resulted in 94 hybrid progenies. This F_1 population was planted in a Missouri State Fruit Experiment Station (MSFES) vineyard in 2007 and has yielded fruit for the past two years. Fruit and productivity traits were measured in 2012. Specific variables measured included vine yield, number of clusters per vine and shoot, cluster weight, number of berries per cluster, berry weight, juice pH, titratable acidity, berry anthocyanin concentration and vine size. Additional crosses were made in 2011; we have acquired 134 additional genotypes surviving the winter of 2012. Indeed, this F_1 population of Norton x Cabernet Sauvignon cross is the foundation for this project. A segregation of powdery mildew resistant phenotype was also evaluated under *in vitro* and green house conditions in Fall 2013, resulting in 64 resistant and 68 susceptible hybrid genotypes, fitting the expected ratio of 1:1 (Figure 1). The data suggests that there is a heterozygous resistance quantitative trait locus (QTL) with a dominant resistant allele in Norton. In addition, the two parents were successfully evaluated for downy mildew and *B. cinerea* resistance (Figure 2 and 3).

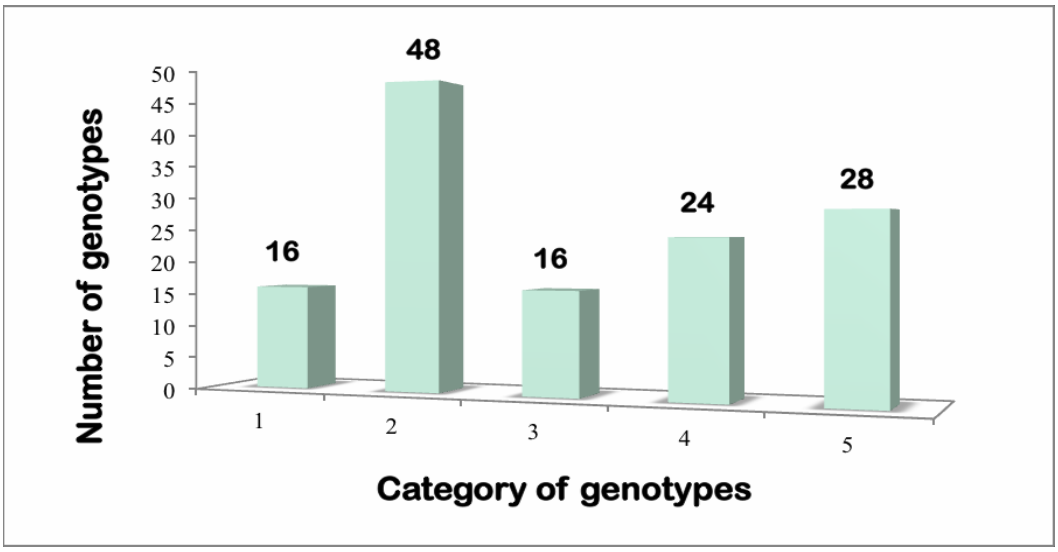

Figure 1. Visual rating for powdery mildew phenotyping. 1 is no growth of sporangia, 2 and 3 are most restricted and restricted growth whereas 4 and 5 and extended and most extended growth based on OIV452 descriptor adapted to the leaf disc assay. The category shows that ratings 1 and 2 3 show various degree of resistance whereas ratings 3, 4 and 5 are more towards susceptibility.

Figure 2. Visual rating for downy mildew phenotyping. Norton (left) is resistant to *P. viticola* while Cabernet Sauvignon is highly susceptible.

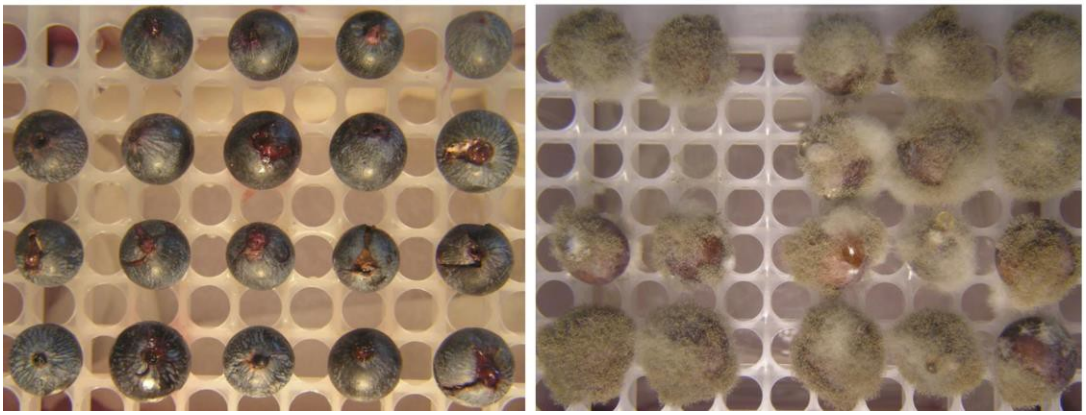

Figure 3. Norton berry (left) is resistant to *B. cinerea* while Cabernet Sauvignon berry (right) is highly susceptible

Construction of a Norton genetic linkage map

There are more than 800 SSR markers that have been isolated in grapevine to date. The markers are publicly available and are described in the NCBI databases dbSTS and UniSTS http:/www.ncbi.nlm.nih.gov/. They also have been incorporated into several genetic maps. These maps have assisted in identifying genetic markers tightly linked to flower sex, berry color, fruit yield, seedlessness, and disease and pest resistance. In terms of our Norton x Cabernet Sauvignon population, we have tested 600 SSR markers with the parents and four F_1 progenies and identified 383 polymorphic markers. Further polymorphic marker identification is in progress on the remaining markers. We are currently screening the entire population of 192 genotypes with the identified polymorphic markers to construct a Norton genetic map of all 19 chromosomes. Several loci in the grape genome have been identified on chromosomes 9, 12, 13, 14, 15 and 18 that confer resistance to powdery mildew, the most widespread fungal disease of grapes in the world. We are using a limited mapping strategy described in Riaz, 2011 to identify the major QTL for powdery mildew resistance in our F_1 population with resistance inherited from the Norton grape. A linkage map including 90 markers clustered in these 6 chromosomes has been constructed (Figure 4). The segregation of powdery mildew resistant phenotype was also evaluated under *in vitro* laboratory and green house conditions. A minor QTL was discovered near markers FAM71 on linkage group 12 with a logarithm of odds (LOD) value of 2.7 that explains about 16 % of the total phenotypic variation (Figure 5). Further genotyping and phenotyping screening are necessary to identify additional resistance loci that are responsible for powdery mildew resistance. Nevertheless, this data already provides the foundation and tools to associate molecular markers with powdery mildew resistance of Norton even though genetic mapping of all 19 grape chromosomes is not yet completed.

***Riaz S**, Tenscher AC, Ramming DW and Walker MA (2011). Using a limited mapping strategy to identify major QTLs for resistance to grapevine powdery mildew (Erysiphe necator) and their use in marker-assisted breeding. Theor Appl Genet **122**: 1059-1073.*

Based on the original work plan above, we have made the progress as promised in the proposal. A solid foundation for the future Norton breeding program has been established and includes: 1) the identification of the true hybrids between Norton and Cabernet Sauvignon, 2) expansion of the mapping population, screening of polymorphic markers in the population, 3) construction of the first 6-chromosome Norton genetic map, 4) development of the phenotyping

protocols for powdery mildew, downy mildew and *Botrytis* bunch rot, 5) preparation for place traits on this map and 6) associating the genetic markers to these three fungal disease resistance in Norton.

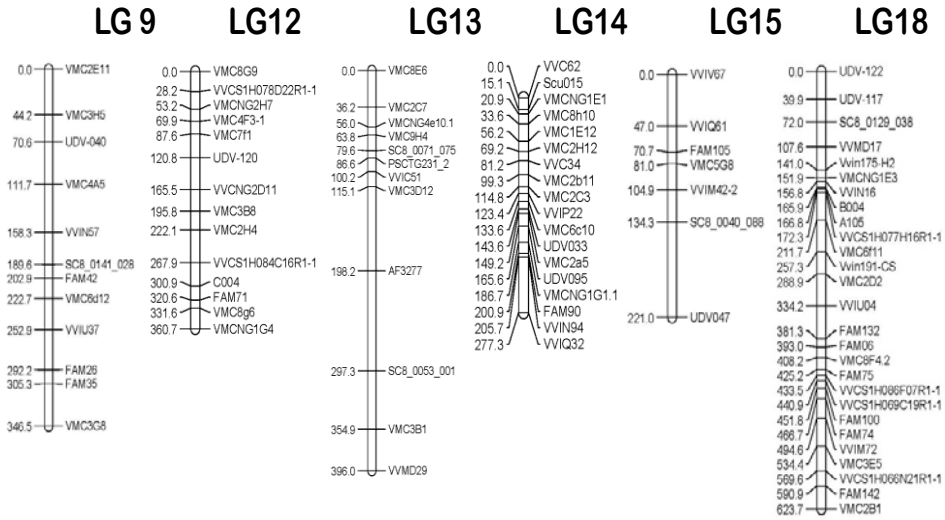

Figure 4. The haploid map of *V. aestivalis* "Norton" with 6 linkage groups

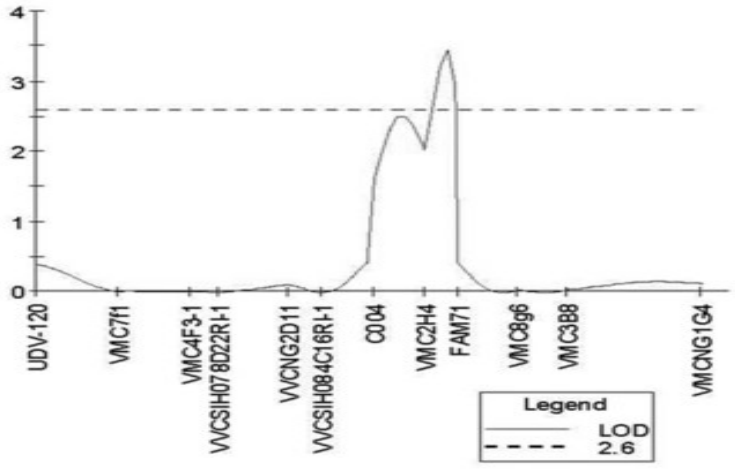

Figure 5. A minor QTL has been detected on linkage group 12, linked to a marker FAM 71. The putative QTL that was detected explained about 16% of the total phenotypic variation.

Goals & Outcomes Achieved

Completed the flower emasculation, pollination and seed harvest in the vineyard to increase the genotype of the mapping population

Compared three SSR marker-banding patterns among the parents and F_1 population to eliminate the off-types (not true hybrids) from the existing 99 F_1 and newly developed genotypes. It is possible to observe up to 30% off-types in a cross from both selfings and outcrossing.

Expanded the existing mapping population of *V. aestivalis*-derived 'Norton' x *V. vinifera* 'Cabernet Sauvignon' from 92 to 192 genotypes for linkage map construction and selection for potential new cultivars.

Tested >800 SSR markers for potential polymorphism on a small set of DNA including parents and 6 F_1 genotypes and 359 of which have been identified as polymorphic markers for Norton.

Conducted a segregation analysis on powdery mildew resistance (Figure 1)

Established new procedures for downy mildew and *Botrytis* bunch rot resistance assays in the laboratory and greenhouse (Figure 1, 2, and 3).

Constructed a 6-chromosome Norton genetic linkage map with 90 SSR markers using JoinMap 4.1 software (Figure 4) based on SSR markers.

Quantify the phenotyping data using statistic software

Discovered a minor QTL near the marker FAM71 on linkage group 12 (Figure 5), and a manuscript is in progress to report this finding

Provided summer internships to work on grape molecular breeding program
To identify the QTLs, a mapping population of 184 individuals was constructed from a cross between *V. aestivalis*-derived 'Norton' and *V. vinifera* 'Cabernet Sauvignon'. A haploid Norton genetic map will be constructed with more than 350 polymorphic SSR markers clustered in 19 linkage groups. In collaboration with VitisGen (www.vitisgen.org), approximately 170,000 single nucleotide polymorphism (SNP) markers generated by genotyping-by-sequencing (GBS) will be identified in this population and will be integrated with SSR markers to construct a high-resolution linkage map. In preparation for placing traits on this map, phenotyping assays for powdery mildew, downy mildew and *Botrytis* bunch rot resistance have been established and will be applied to the population. Careful genetic mapping of this population provides the foundation and tools to associate molecular markers with these three fungal disease resistance traits of Norton for future new cultivar release.

Proposed Activities	Accomplishments
Identification of polymorphic markers using parents and 6 F_1 genotypes (techniques include DNA isolation, polymerase chair reaction (PCR), gel electrophoresis and DNA fragment analysis via capillary electrophoresis)	Additional crosses were done in the vineyard to increase the number of genotypes in the F_1 population. Using SSR markers, true hybrids have been identified, and the mapping population has been expanded from 92 to 192 genotypes. More than 800 SSR markers were tested and 359 of which were identified as polymorphic markers for a genetic map construction

Genotyping the entire population with polymorphic markers for the construction of the Norton genetic linkage map using JoinMap 4.1 software	Using a published limited mapping strategy, a 6-chromosome Norton genetic linkage map with 90 SSR markers was constructed using JoinMap 4.1 software
Phenotyping powdery mildew, downy mildew and *Botrytis* bunch rot disease index in the laboratory, greenhouse and vineyard	A segregation analysis on powdery mildew resistance was completed with a resistant/susceptible ratio of 64/68 (Figure 1) and a minor QTL was identifies on chromosome 12 (Figure 5). New protocol for downy mildew and *Botrytis* bunch rot resistance were developed and test on the parents (Figure 2 & 3)
Evaluation the F_1 population for adaptability, productivity and winemaking quality as well as select appropriate plants for backcrosses	Fruit and productivity traits were measured in Fall 2012. Specific variables measured included vine yield, number of clusters per vine and shoot, cluster weight, number of berries per cluster, berry weight, juice pH, titratable acidity, berry anthocyanin concentration and vine size. Based on these phenotype data, six individuals from this F_1 population were selected for wine making and commercial vineyard trials.

Proposed Measurable Outcomes	**Achieved Outcomes**
Develop a mapping population between Norton and Cabernet Sauvignon. An ideal mapping population size for establishing a framework genetic map is about 200 progeny.	A mapping population has been established with 192 genotypes and maintained by the professional field crew at Missouri State Fruit Experiment Station (MSFES), Mountain Grove, MO
Identify the true hybrids from the new crossed in 2011 and 2012	More than 100 crosses between Norton and Cabernet Sauvignon were performed at MSFES in the summer of 2011. About 250 additional seeds were harvested. A high percentage, 86%, of true hybrids were acquired in the crosses.

Construct a Norton linkage map to lay a foundation for future grape breeding	A 6-chromosome genetic map of Norton has been constructed with 90 SSR markers. Additional 180 polymorphic markers clustered in the other 13 chromosomes have also been identified. A Norton genetic map with 19 chromosomes is in progress and will be available to the grape research community soon.
Associate the markers linked to powdery mildew, downy mildew and *Botrytis* bunch rot.	A segregation analysis on powdery mildew resistance was completed (Figure 1). Using a limited mapping strategy, a minor QTL was identified on chromosome 12 (Figure 5). New protocols for downy mildew and *Botrytis* bunch rot resistance were developed and tested on the parents (Figure 2 & 3)
Evaluate the viticultural and enological traits and determine the commercial potential of Norton/*V. vinifera* F_1 hybrids with *Botrytis* bunch rot resistance.	Six cultivars have been chosen and are being evaluated at two different locations in addition to MSFES. The two sites of testing are the Chaumette vineyard and winery at Sainte Genevieve, in southeast MO and the Meyers Vineyard at Mount Vernon, in southwest MO.
Provide summer internships to work on grape molecular breeding program	Ten summer interns in 2012 stayed at MSFES for 3 months to learn via hands-on experience in the laboratory and vineyard

Beneficiaries

Using the *V. aestivalis*-derived 'Norton' as a perennial woody model plant, the work presented in this proposal provides an exceptional opportunity in both research and education. It includes interdisciplinary training opportunities for students in plant breeding, genetics, genomics and plant pathology with a specific focus on viticulture. The grape and wine industry will be aided by new grape varieties. The education program has included hands-on experience both in the laboratory and vineyard, and produce highly trained professionals that will address the need for a knowledgeable and skilled workforce for the American grape and wine industry. We have recruited two graduate students and ten summer interns to work on grape powdery mildew, downy mildew and *Botrytis* bunch rot resistance. These focal areas target three of the most destructive diseases in the wine and grape industry.

The Project Director, Dr. Chin-Feng Hwang, has been invited to the following conferences to present the research results from this project: American Society of Enology and Viticulture (ASEV), North America Grape Breeding Conference (NAGBC), Midwest Grape and Wine Conference (MGWC) and the Missouri Wine and Grape Research Board (MWGRB). A manuscript on the construction of the Norton linkage map is in progress. Once published, it will be distributed to the grape breeding and genetics community worldwide. In addition to the

professional conferences, the results also being presented at grower meetings in conjunction with viticulture/enology advisors to better educate growers on the value of molecular breeding and the benefits of improving Norton. Furthermore, the Missouri State University leads the Viticulture and Enology Science and Technology Alliance (VESTA) Program, a partnership of institutions in 17 states, funded as a National Center of Excellence from the National Science Foundation's (NSF) Advanced Technology Education program. This program is focused on the development of online educational materials and training workshops for secondary students, teachers, farm advisors, grape growers and enologists. The new knowledge produced from this project has been disseminated to the adult learner through VESTA program. The location of this work at the Missouri State Fruit Experiment Station at Mountain Grove is situated in a rural region of Southern Missouri and serves Northwest Arkansas. The project provides access for science education and training of biotechnology for high school students and teachers. Based on the data in Table 1, there are approximately three thousand people worldwide affected by the distribution of this new knowledge.

Table 1. The number of people affected by the distribution of this new knowledge

Dissemination Sources	ASVE (June 24-	NAGBC (August 14-	MGWC (February 7-9, 2013)	MWGRB (June 22 & Nov. 5,	VESTA (2013)
Number of people participated	1100	100	400	100	900

Lessons Learned

Studies on the inheritance of quantitative traits can at times be problematic because these traits are affected not only by the actions of multiple individual genes, but also by the interactions between genes (epistasis) and between genes and environmental factors. Trait phenotyping is nearly always limited by environmental interactions and epistasis; both can mask the value of alleles and of individuals of interest. Thus, QTLs characterized in one genetic background or environment may behave differently in a different environment. Pathogen stress imposed by powdery mildew, downy mildew and *B. cinerea* can be unpredictable and sporadic. To diminish these problems, we also performed the artificial inoculation of *E. necator*, *P. viticola* and *B. cinerea* in the laboratory and greenhouse. This assay greatly increases the probability of identifying variation due to genetics rather than environmental factors.

This study initially involved crossing Norton with *V. vinifera* 'Cabernet Sauvignon'. However, we also crossed Norton with 'Syrah', 'Pinot Noir' and 'Merlot' and the *Vitis* interspecific hybrid 'Vignoles'. A high percentage of hybrids were acquired in all of these additional crosses (70% to 93%) except for Norton x Merlot (16.6%), where all the non-hybrids showed the Norton microsatellite banding patterns, indicating a probable emasculation error resulting in self-pollinated plants.

The original proposed project was designed based on our infrastructure and capacity. We completed the proposed work in a timely manner with only $63.81 remaining in the budget.

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Additional Information

To set up a downy mildew assay system, one of Dr. Hwang's graduate students, Surya Sapkota, received a National Science Foundation (NSF)-Grape Research Coordination Network (GRCN) scholarship to work with Drs. Lance Cadle-Davidson and David Gadoury for two months (January 20 to March 25, 2013) at Cornell University. During this visit, downy mildew sporulation and disease development was studied using leaf disc assay in Norton and Cabernet Sauvignon. An equal amount of sporangial suspension with known concentration was inoculated to evaluate disease progression and resistant reaction. An improved method of sporangia handling and counting was developed, and a manuscript is in progress for future publication.

In general, the School of Agriculture at Missouri State University offers about 10 summer internships every year. The two graduate summer assistantships provided from this funding were awarded to two MS graduate students, Surya Sapkota and Xu Chen. Working together with Li-Ling Chen (Research Specialist), the graduate students were able to gain teaching experience by direction the summer interns in the laboratory to 1) isolate DNA from grape leaves, 2) determine the concentration of isolated DNA using a spectrophotometer, 3) visualize DNA via electrophoresis, 4) perform polymerase-chain reaction (PCR) and 5) run DNA fragment analysis via capillary electrophoresis. The purpose of these procedures was to verify the true hybrids at the seedling state by using DNA markers. In the vineyards, they were also able to provide the hands-on experience with traditional breeding techniques including parental selection, flower emasculation and pollination.

Project 12: Winter Vegetable Production Project

The Webb City Farmers Market
Eileen Nichols
Final Performance Report

Project Summary

Southwest Missouri and adjoining areas have seen an explosion of interest in locally grown fruits and vegetables from a variety of markets. In tandem with this interest from consumers, the region has seen a sustained development of commercial scale production of these crops. Many of these producers have less than 5 years of commercial production experience, and along with their more experienced colleagues, eagerly support outreach education efforts that address issues of interest to fruit and vegetable producers. Traditionally production has focused on an April – November season, but innovative vegetable farmers have demonstrated the potential for winter production.

A benchmark to gauge the sustainability of fruit and vegetable production in southwest Missouri is the number of high tunnels constructed in recent years. The NRCS High Tunnel cost share initiative has spurred the adoption of these production tools, which initially helped extend the growing season in spring and fall. More recently high tunnels are recognized as an important component of winter production. To date, 443 NCRS high tunnels have been approved for Missouri. In addition, numerous high tunnels were already in operation and others have been constructed outside of the NCRS program.

There is also strong interest among consumers for a 12-month supply of locally grown fruits and vegetables. Several area farmers markets, such as Webb City Farmers Market, Farmers Market of the Ozarks, Greater Polk County Farmers Market and Greater Springfield Farmers Market, have expanded operations to 12 months, and these markets report a strong need for additional winter production. Farmers markets are particularly suited to beginning specialty crop growers because of low overhead and ease of entry into direct marketing. Institutional markets (grocery stores, hospitals, educational facilities, prisons, restaurants) have a documented interest in locally produced crops, and would welcome a consistent, reliable, 12-month supply. In some cases, such as schools, the majority of the marketing opportunity would be for winter-produced specialty crops. Winter specialty crop production offers opportunities for small scale diversified Missouri farms, as well as specialized farms of larger size. Winter grown crops are in high demand and consistently profitable. Winter produce offers opportunities for certified organic production in Missouri. Diverse marketing opportunities abound, including direct market fresh sales and sales to institutional markets.

There is also an on-going need for food safety training among specialty crop growers. Beginning growers need an introduction to the subject, experienced growers need to update and expand their knowledge.

A Specialty Crops grant was used by the market in 2010 (12-25-B-0933) to introduce high tunnel technology and Food Safety: From Farm to Market to Southwest Missouri. Several high tunnel construction and production workshops since then have been well attended, and evaluations from the workshops uniformly support high tunnel educational activities.

Project Approach

2013 Winter Vegetable Production Conference was held. Our goal was to attract 75 growers to the conference. We had over 150 persons attend. Topics included – the Ins and Outs of Winter Production, Lettuce in January? Yes, and so much more; Winter Production for beginners; Farming in the Winter and Making Money Doing It; Movable and Fixed High Tunnels; Filling the Table – How we use season extension and root cellars to keep 30+ items on the table year-round, How We Average $5,000 a Week in the Winter. In addition, we hosted a panel of experienced local winter growers, a breakout session for Hmong growers with an experienced Kansas City Hmong winter producer' and a tour of the Green's Greenhouse operation which included 3 high tunnels in production. Feedback has been very positive.

In 2013**, two food safety workshops** were co-sponsored, one in Mountain Grove (partnering with MSU), and one in Springfield (partnering with Farmers Market of the Ozarks). Both received excellent evaluations by participants. The Mountain Grove workshop had 29 participants. The Springfield workshop had 82 participants in the English language session and 11 in the session translated into Hmong.

The 2013 Spring Tour, despite inclement weather – how appropriate for Winter Production - had 33 participants (3 more than the project goal). Participants visited:

1. Echigo Farms—this year-round farm includes two large high tunnels, many low tunnels and nearly three acres of outside permanent beds. They practice no-till, low input, natural farming methods studied while living in Japan.

2. Millsap Farms—using high tunnels, row cover and greenhouses to produce tons of spinach, pac choi, lettuce, and other greens, the farm sells right through the winter through a CSA, farmers market and grocery stores. In addition to the greens, the "Roots, Squash and Greens CSA Share" includes storage crops like sweet potatoes, onions, Irish potatoes, and acorn, butternut, and spaghetti squash, along with fresh root crops like turnips, carrots, beets, radishes. Recently erecting a Chinese style high tunnel with a bermed north wall, gabion cage heat retention and a moveable insulation layer.

3. Urban Roots Farm—growing produce in heated greenhouses, moveable high tunnels and row cover, the farm markets through a local grocery store, farmers market and CSA.

In addition, we were able to arrange, at a reasonable cost, for the participants to eat lunch at a Springfield restaurant which uses locally sourced produce and meats where they learned about marketing opportunities for winter production. This meal was an educational component of the bus tour. The restaurant owner provided information to the participants regarding how he sourced local foods, what his requirements where and fielded questions. It was necessary to provide a meal because the bus tour was a full day tour and to take time out of the schedule for participants to find their own lunch would have seriously diminished the time available for the tour.

The 2013 Fall Tour included 40 people (10 over the original proposal). Presenters included the farm owners, representatives from University of Missouri Extension and Lincoln University Cooperative Extension.

Farms visited include:

1) Braker Berry Farm—operates two high tunnels with over 7,000 square feet of space. The farm grows for a winter CSA for employees of a Joplin hospital and for the Webb City Farmers Market. This is the farm's third year of growing in high tunnels.

2) Nature Valley Farm—installed their high tunnel in spring of this year when they got an early start with boc choy, spinach and other greens, as well as zucchini, squash and green beans.

3) Ozark Country Creations—specializes in tomatoes, strawberries, onions, and cucumbers. Tomatoes are sold on the farm store about 8 months of the year. High tunnel tomatoes begin late April and then a fall crop from the tunnel is available into December.

4) Green's Greenhouse and Gardens – operates three high tunnels, two of which are planted in primarily in tomatoes, peppers, and cucumbers. The third is currently planted in annual strawberries to give the tunnel a break from tomato production. The Green's also grow in two very large cold frames (4 x 30 feet) where they produce late season green beans and greens.

Lunch was served in route at a Methodist church – vegetable/beef stew featuring locally grown vegetables. It was necessary to provide a meal because the bus tour was a full day tour and to take time out of the schedule for participants to find their own lunch would have seriously diminished the time available for the tour.

The market teamed with Lincoln University Cooperative Extension to put on two 2-day workshops on **Farm Food Safety**. The workshop for English-speaking farmers hosted 47 people and included one day of presentations and a one-day computer lab to design individual farm plans. This workshop was led by two representatives of Cornell University. The Hmong-speaking workshop was attended by 20 people and featured one day of presentations and one day of on-the-farm practical hands-on instruction. This workshop was led by two representatives of the University of Minnesota. (The working lunch and supplies were funded by the Specialty Crops grant. Lincoln University Cooperative Extension covered all other costs.)

A **follow-up survey** was sent by email or US postal mail to the participants in the 2013 Winter Production Conference and the 2013 Spring Tour and 2013 Fall Tour. Results follow at the end of this report. These results were shared at the 2014 MOSES conference as a poster.

The 2014 Winter Production Conference was held November 10 and 11, 2014. Approximately 100 professional growers and agriculture educators attended. Presentations have been posted to the market web site. (The Specialty Crops grant funded a portion of the transportation, publicity and materials cost.)
All projects received significant contributions from the partner organizations – Webb City Farmers Market, Lincoln University Cooperative Extension and University of Missouri Extension. In particular, Webb City's Manager provided a majority of the organization for the winter production conferences, while Lincoln Extension organized the tours and the 2-day Farm Food Safety Conference, and MU Extension organized the food safety workshops and did all surveying.

Goals and Outcomes Achieved

See above for activities achieved.
Survey results are at the end of this report.

The Webb City Farmers Market reports the following sales during its Winter Market. These figures include all sales, produce, baked goods, etc.

Date	2014	2013	2012*
Winter Market			
1/4	2,263	2,718	2,376
1/11	1,868	1,498	
1/18	3,174	3,315	2,468
1/25	1,379	1,255	
2/1	2,057	2,897	1,900
2/8	1,195	1,271	
2/15	1,928	2,237	1,420
2/22	1,681	cancelled	

3/1	1,906	3,302	1,749
3/8	1,862	815	
3/15	3,134	2,670	1,606
3/22	2,699	1,249	
3/29	2, 238	2,190	
4/5	3,812	2,738	2,933
4/12	5,099	1,676	765
4/19	5,598	3,619	2,031
Winter/Spring totals	**41,893**	**33,450**	**17,248**
11/1	4,320	5,558	2,240
11/8	4,770	4,950	1,515
11/15	6,822	5,138	2,342
11/22	5,423	5,862	
Holiday Market	1,969	1,775	2,579
11/29	2,791	2,567	1,378
12/7/06	3,817	cancelled	2,833
12/13	4,182	3,705	1,786
12/20	5,919	1,678	3,032
Holiday Market	1,842	1,255	1,152
12/28	1,656	2,612	536
Fall/Winter totals	**43,511**	**30,100**	**19,393**
Annual Totals	**85,404**	**63,550**	**36,641**

*In fall of 2012, the market went from 2 markets a months in the spring to a weekly market in the fall. This was due to the interest of growers in selling weekly at the winter market.

Post meeting surveys of attendees measured the specific learning experience, with a goal of 60% of attendees demonstrating an increased awareness of winter production practices following the conference.

Approximately 70% of attendees responded, stating they planned to change their farming practices as a result of the 2013 conference. 98% stated they would recommend the conference to others.

Conference attendees were surveyed 12 months following the workshops, to measure medium range impacts, with a goal of demonstrating the adoption of progressive winter specialty crop production practices by 25% of conference attendees.

Of the attendees responding to the survey, 55% said they had made changes in how they stored vegetables as a result of the survey. 24.4% had installed a high tunnel since attending the conference. 75% said they had used season extension techniques following the conference.

Attendees at the Mountain Grove Food Safety Workshop reported a knowledge gain of 3.476 on a 1-4 Likert scale with 4 representing a “great deal of knowledge gain”.

Beneficiaries

Based on observation, the Winter Production Conference was attended by approximately 100 professional or aspiring professional farmers, with the remaining attendees evenly split between state, federal, and extension educators/staff and amateur growers. Growers from the Webb City, Greater Springfield and Farmers Market of the Ozarks attended the conference. Based on Webb City's experience, those markets and their customers benefitted from a greater supply of winter produce. The Webb City Farmers Market showed an increase in overall winter sales of 65% during November, 2013, through December, 2014, ($115,504) as compared with January, 2012, through April, 2013 ($70,091). The increase is probably higher because the 2012 - 2013 period includes three months (February, March and April, 2013) which occurred after the conference when farmers could use their newly-acquired knowledge.

The Food Safety workshops and conferences were almost 100% attended by professional growers. One assumes that all the markets the growers sell through and their customers benefitted from safer growing practices as a result.

The farm tours were primarily attended by professional growers.

Lessons Learned

Perhaps the most practical lessons learned were those of organization and planning. We learned to structure the conference fee to cover per person costs. We should have set the conference fee high enough to cover the meal and materials costs for additional attendees. We did so in the 2014 conference. We should also have set a maximum number of attendees. Our space was too crowded in 2013. Again, we implemented this lesson in the 2014 conference. We need to come up with a better speaker system, preferably with some wireless microphones.

Our target audience was professional or aspiring professional growers. We set the 2013 registration fee so low that hobbyist growers attended. We raised the fee in 2014 and had only two or three hobbyists attend.

Presenters did not provide hand outs in digital form for us to reproduce in 2013. We required them in 2014 (and just about destroyed my copier providing them to the attendees). Lesson learned – make timely-delivered handouts a requirement of presenters and budget enough to do the photocopying. We relied on others to video the presentations in 2013. We ended up with no video – bad sound was the response. So we videoed the presentations ourselves in 2014 (and received permission to do so from our presenters).

Attendees responded very positively to the presenters and the materials provided in the 2013 conference. We received a great deal of useful feedback to use in planning future conferences.

Results of the project were so positive that the state encouraged us to hold the 2014 winter production conference. We have secured Specialty Crop funding to hold winter production conferences in 2016 and 2017. There continues to be much interest by growers in winter production and markets are still crying out for produce. Last Saturday at the Webb City market every piece of produce was sold out 45 minutes before closing time.

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Additional Information

Evaluation: Winter Vegetable Conference – Joplin, MO – February 5, 2013

The information you provide will not be used to identify any program participants. You may refuse to answer any questions. Your answers to the following questions will help University of Missouri Extension make sure that we are presenting valuable programs to a wide range of participants and will aid in future planning and training improvements. We appreciate your time and input. Please circle or mark appropriate answer.

		Poor	Fair	Average	Good	Excellent
		1	2	3	4	5
1.	**How would you rate the overall program (%)?**	**0%**	**0%**	**0%**	**31%**	**69%**
Average rating (1-5 Likert Scale)			**4.687**			

		Poor	Fair	Average	Good	Excellent
		1	2	3	4	5
2.	**How well were your expectations met in this program (%)?**	**0%**	**0%**	**3%**	**30%**	**67%**
Average rating (1-5 Likert Scale)			**4.647**			

3. I would recommend this program to others. YES 100% NO 0%

4. Overall, after completing this workshop, do you think your knowledge gained of pest management and safe production practices has increased:

a great deal	a moderate amount	a little	not at all
4	3	2	1
73%	25%	2%	0
Average knowledge gain (1-4 Likert scale)		**3.709**	

Listed below are the topics presented during this workshop. On the left, circle your knowledge of each topic BEFORE the workshop. On the right, circle your knowledge of each topic AFTER the workshop.

How confident you are in using these practices or researching information after the workshop (percentages):

5.	Question:	Non-existent	minimal	moderate	considerable
		1	**2**	**3**	**4**
1	Season extension	0	7.865169	43.82022	48.31461
2	Vegetable storage	0	6.896552	51.72414	41.37931
3	Marketing winter vegetables	0	11.76471	47.05882	41.17647
4	Winter vegetable production practices	0	6.976744	48.83721	44.18605
5	Winter vegetable pest management	0	9.411765	55.29412	35.29412
6	Use of row covers and low tunnels	0	16.86747	50.60241	32.53012

Knowledge gain

	Question:	Pre Evaluation score	Post Evaluation score	Knowledge gain (1-4 Likert Scale)
1	Season extension	2.274336	3.508929	1.234592
2	Vegetable storage	2.19469	3.333333	1.138643
3	Marketing winter vegetables	2.054545	3.297297	1.242752
4	Winter vegetable production practices	2.09009	3.371681	1.281591
5	Winter vegetable pest management	1.9375	3.0625	1.125
6	Use of row covers and low tunnels	2.184211	3.473684	1.289474
	Average knowledge gain			**1.219**

6. Please comment on the presenter's skills so that we can improve. *Did presenters encourage questions? Keep me focused and interested? Did the presenters use clear examples? Were they well-prepared?*

- If they would have a little bit longer to talk, so they could spend a little bit more time on the different stuff they're discussing.
- Yes, yes, yes, yes! Good presenters.
- Yes, yes, yes, yes. The Q&A with Local farmers was very informative.
- All were very good to excellent.
- Presenters very knowledgeable and friendly. Probably could have talked a little slower, but they were packing a lot of info into a short time.
- Presenters were excellent – very well articulated and prepared.
- Michael did a fantastic presentation. Very informative and organized. Learned much about the equipment needs for large scale tunnel/field production.
- Enjoyed the panel session as good questions were asked and addressed.
- Excellent. Could you ask the speakers to repeat audience questions so we will know what the questions are?
- Great job. It was very good presented in all phases.
- Yes. Very focused. Like the examples. More handouts from their farms. Yes.
- Yes.
- Presentations went beyond my expectations. I was surprised by the knowledge and expertise of the presenters and panel.
- Enjoyed break-out session.
- The presenters did a great job presenting. I had a hard time staying awake though.
- Super presentation by all.
- Fantastic!
- All good – Moderator should signal speaker when time is getting low. I appreciate the diversity of speakers, esp. LIZ and Mark Frank (Japanese farmer).
- They were all good.
- Great.
- Wonderful!
- All were excellent!
- Very good.
- Great speakers. Mike is so knowledgeable.
- All were great.
- They were all good.
- Yes.
- Excellent.
- Presenters were eager to share their knowledge. Most were very well spoken and appeared to a newbie like me, to be very knowledgeable and experienced.
- All presenters were very well prepared and answered all questions. Pov Huns was a bit less clear during his presentation (more scattered info).
- Very impressive. Most if not all information provided, has aided in production ideas for our given area. Many of the practices demonstrated can easily be adopted for our area for increased
- I don't think you can improve. The presenters were excellent.
- Great presenters.
- Need a list source for all markets in area.
- All very good.
- Very good day. Excellent presenters. Also, got a good seat early where I could see much better. Panel very helpful with audience questions.
- No complaints. All presented very well.
- The presenters have done an outstanding job…good slides, good coverage of topics, etc.
- Very well prepared, very informative, inspirational.
- Adam and Michael were GREAT speakers. Pov was a little too interested in joking rather than teaching.
- Yes in all cases.
- Yes to all.
- Enjoyed the personal experiences. Good interaction with crowd. Lots of good information.
- Good job.
- Yes, yes, yes, yes. Excellent presenters.
- All good. Would like more slides.
- Excellent!
- Yes, yes, yes, yes. Everyone was so informative, so eager to answer questions and able to send us to someone else if they couldn't.
- Yes, yes, yes. Both excellent.
- Yes, yes, yes, yes.
- Great. I believe they have done a great job. If they do not know an answer, they have been honest and tried to get answers.
- Job well done!
- Presenters did well. Adam was my favorite!
- They were all so knowledgeable. Excellent presentations.
- All presenters were excellent. Can't think of a negative thing to say. Excellent conference. I feel very inspired (and a little over-whelmed)!
- Great presentations. Practical. Application for home gardens to large market gardens.
- Very good!
- Thought each presenter did a good job. They gave a lot of info in a short amount of time.
- Yes.
- Very knowledgeable on their operations. Well prepared for their presentation. Able to answer most questions that they fielded.
- All did a good job. The two, young, main presenters did an excellent job at all of the above. Inspiring!
- Yes, yes, Sometimes- for beginner, the pace was too fast. But experienced farmers probably soaked it all in, yes.
- Excellent real life examples, tips, $ examples, all very helpful!
- Well done.
- Michael is hugely inspirational and obviously knows his subject. Every offhand comment is a gem of info.
- Very good. Yes. Yes.
- Well prepared, and very interesting.
- All were excellent.
- Yes, yes, yes, yes.
- All presenters were well prepared, great experience. Nice that they are willing to share info.
- Very helpful to me at my level and upgraded my overall knowledge and readiness to move to another level of

production times and extended season. • They were great! • Yes, yes, yes, yes.	gardening. • Very good. Thank-you!

7. What will you do differently as a result of this program (percentages)?

	Did Before Workshop	*Plan to Do in Next 6 Months*	*No Plans to Use this in My Operation*	*Does Not Apply in My Operation*
Change the way I store vegetables	10.89108911	69.30693069	6.930693069	12.87128713
Consider season extension to enhance my farm	13.7254902	75.49019608	3.921568627	6.862745098
Change the way that I market vegetables	10.20408163	61.2244898	10.20408163	18.36734694

8. Please list 2 things you learned during the winter vegetable conference that you will take back home and use in your farm or garden.

• Vegetable storage cooler use • soil prep and natural pesticides • high tunnels! • Irrigation • leaching • various cold-weather covering methods • new storage options • extending seasons into early winter • cleaning/production options • row covers • low tunnels! • Hoop houses (including layout) • microleverage • market-friendly varieties • types/length of storage for winter vegetables • using bees and lady bugs • tighter row-growing in tunnels • cover crops • planting garlic on top of covers • CSA information • using grass shears to cut lettuce • plant down the middle of the tunnel and walk down the sides • rougher soil is well-used for growing brassicus • take farm records • grafting tomatoes	• farm economics and knowing the cost of production • what types of veggies to grow • biotello plastic • season extension techniques • storing onions at 34 degrees • storing butternut squashes • how to grow what during winters in SW missouri • contacts and friends made! • How to market produce • CO2 starvation in greenhouses • list of products • procedures for specific crops/rotation cycles • winter-hardy varieties • POV HUMS permaculture style field gardening • suppliers for products • root pits • marketing • cultural practices • fertilization techniques and uses • compost use • no-till farming • growing in raised beds and using mulch • overwintering crops • growing microgreen for personal use • root cellars • growing spinach is easier than I thought

9. What suggestions do you have for making this program more effective?

• Larger space • chairs/tables to write on • provide product examples • more break-out sessions	• cover no-till gardening, more about planting and transplanting specifics, in topics • elicit more audience participation • hold more frequently (annually)

• limit number of people to those the space can accommodate • longer presentations from vendors • temp in room was either too hot or too cold • better seating arrangement • providing explanations of terms and acronyms • include more veggies/fruits for breakfast • speaker repeat questions during Q&A sessions • have locals who have built tunnels present at the next conference • schedule conference on a wed/thurs • have slides available (as print-outs) at the beginning of the day for participants, or email prior to conference so they can print them out at home and bring to take notes (especially for those who pre-register)	• provide more info on grants, loans, and assistance programs • pricing difference for those who cannot consume meals due to dietary restrictions • attract a younger audience • mandatory pre-registration • have a "question box" so participants don't have to wait for emailed responses to their questions • advertising more formally so people know when something like this is coming up in the future • have tea available • make it longer • better directions to location • more female speakers or successful farmers • more interaction and less lecture • Food safety/GAP

Evaluation: Winter Vegetable Conference – Joplin, MO – February 4, 2013

The information you provide will not be used to identify any program participants. You may refuse to answer any questions. Your answers to the following questions will help University of Missouri Extension make sure that we are presenting valuable programs to a wide range of participants and will aid in future planning and training improvements. We appreciate your time and input. Please circle or mark appropriate answer.

		Poor	Fair	Average	Good	Excellent
		1	2	3	4	5
1.	How would you rate the overall program?	0%	0%	3%	34%	63%
Average rating (1-5 Likert Scale)			**4.611**			

		Poor	Fair	Average	Good	Excellent
		1	2	3	4	5
2.	How well were your expectations met in this program?	0%	1%	3%	40%	56%
Average rating (1-5 Likert Scale)			**4.500**			

- **I would recommend this program to others**. YES 96% NO 4%

5. Overall, after completing this workshop, do you think your knowledge gained of pest management and safe production practices has increased:

a geat deal	a moderate amount	a little	not at all
4	3	2	1
62%	35%	3%	0%
Average knowledge gain (1-4 Likert scale)		**3.580**	

Listed below are the topics presented during this workshop. On the left, circle your knowledge of each topic BEFORE the workshop. On the right, circle your knowledge of each topic AFTER the workshop.

How confident you are in using these practices or researching information after the workshop (percentages):

5.	Question:	Non-existent	minimal	moderate	considerable
		1	**2**	**3**	**4**
1	Structures used for winter production	0	7.865169	43.82022	48.31461
2	Modifying the environment for winter production	0	6.896552	51.72414	41.37931
3	Using succession plantings	0	11.76471	47.05882	41.17647
4	Getting started in winter production	0	6.976744	48.83721	44.18605
5	Economics of winter production	0	9.411765	55.29412	35.29412
6	Using movable high tunnels	0	16.86747	50.60241	32.53012

Knowledge gain

	Question:	Pre Evaluation score	Post Evaluation score	Knowledge gain (1-4 Likert Scale)
1	Structures used for winter production	2.333333	3.404494	1.071161
2	Modifying the environment for winter production	2.125	3.344828	1.219828
3	Using succession plantings	2.27551	3.294118	1.018607
4	Getting started in winter production	2	3.372093	1.372093
5	Economics of winter production	1.895349	3.258824	1.363475
6	Using movable high tunnels	1.860465	3.156627	1.296161
	Average knowledge gain			**1.224**

6. Please comment on the presenter's skills so that we can improve.

Did presenters encourage questions? Keep me focused and interested? Did the presenters use clear examples? Were they well-prepared?

All are great. This was a stimulating, jump-start for me to begin extending our growing season- which was my main purpose in attending. They did very well. Well prepared and thorough. Excellent. Thank-you. Very knowledgeable. Everyone did a fantastic job. The only way you could do much better would be to actually provide all the material on a DVD or online webinar follow-up. Good job. Well prepared. Adam gave the most information for the time. Questions were good. Can't say enough about all presenters. They stated things clearly, reinforced their meanings and answered all questions. Very pleased. The speakers were very good, but I have no previous knowledge of this type of farming. Just starting to step out of our normal outside style of farming. Yes on all. I just need to get a better understanding and do some trial and error. I do think that maybe there should be a handout on the zones that was spoken of. Excellent presenters. Awesome! The presenters were excellent and well prepared. They were engaging and interesting to listen to. There was time for questions but could have been a bit more time set aside. The break-out session was great and helped with questions but you had to pick one of the three groups. Adam Montri was excellent! Very good. Would have been good to mention before starting Ppt – that all the info. would be available on website or emailed to us. Break-out session super helpful too. They were very open to questions and gave informed answers. I was impressed by how young most of the presenters were and very glad to see them interested in growing produce. They were very well prepared and very easy to understand. Montri – Excellent! Kilpatrick – Very Good. Huns – Very good. Yes to all. Yes. Yes. All were very good. Yes, yes, yes, yes. Presenters did very well. Presenters were knowledgeable. Yes, all good. Lot of extra time for questions. Yes. Yes. All were good. Michael's slides at first were too small to see in	Good presenters and helpful tips. Good examples. Some questions left but may not be known yet in industry. Afternoon economics presentation is a bit basic. Also Dan's slide show. Morning stronger than afternoon. 4 Season Rep was more help Adam – Excellent, Michael- Good, Pov – OK. Yes to all. Adam – Yes, yes, yes, yes. Michael – yes, yes, too fast and too much all at once, yes. Dan – yes, yes, yes, yes, Excellent overall. Good food!!! Knowledge was huge----good communication skills. No change needed! Excellent! Very good! Job well done. Thank-you! Different practice. Learned a lot at the break-out also. Keep it up. Would really like to hear the same speakers also. They gave so much information that I need to hear it again. Adams cost accounting examples were great! Nothing like real life examples… Very knowledgeable speakers. Very fast pace – kind of difficult to take it all in when you are new to the info. All were great. The break-out session was great. Very informative. Yes across the board. All speakers did well. Liked break-out sessions. Good presenters today. Appreciated slides and Q/A sessions. Gave good examples and very knowledgeable. Presenters need to slow down when speaking, please. Adam did an excellent job. Presentation was clear, well presented with a cute sense of humor. Very knowledgeable. Michael is knowledgeable. Would have liked to view slides for longer time. This is all familiar to him but foreign to me. Felt a lot of his presentation was unfortunately missed due to the rush of his presentation. Pov very knowledgeable. Lots of excellent advice from personal experience. Good advice and suggestions.' Dan did a good job sharing his mobile tunnel experience. Great presenters thus far! Appreciated knowing that the presentations were going to be available. Please reserve a suitable larger sized room for this project. Insist on pre-registration. You'll know room requirements. Seating is unruly- Cannot view screen and presenter from ½ of room. Cannot easily mark this survey because room is so limiting to the function and purpose of workshop. Yes. All of the above. All of the presenters did extremely well. It is or should be a given. These individuals are professional farmers not public speakers. As stated before, All preformed extremely well, with many important facts. I would recommend this conference to any other seasonal or new farmer. They were all great. All the presenters were good. The first two were especially good. Michael

back. Very good. .	was a wealth of info. The break-out sessions were great! All good. Break-out sessions should be moderated so that a few people don't dominate the questions to the speakers. Yes!

7. What will you do differently as a result of this program (percentages)?

	Did Before Workshop	*Plan to Do in Next 6 Months*	*No Plans to Use this in My Operation*	*Does Not Apply in My Operation*
Install a high tunnel	36.84211	44.73684	9.210526	9.210526
Produce crops for a winter market	18.42105	63.15789	11.84211	6.578947
Examine the profitability of my production practices	17.5	56.25	12.5	13.75
Change my production practices in my high tunnel	9.859155	43.66197	7.042254	39.43662

8. What else did you learn that you plan to use this year?

Animal vs. Plant compost	how to trap voles
how to analyze the business model of farming—good economic talk!	various varieties to use
New ideas for organic fertilizers	aisle maintenance methods
succession plantings	planting scheduling
growing micro-greens	soil cover crops
learned what other producers are doing to market and produce	how to price products
to implement into our operation	interplanting
Seeder	varieties for higher efficiency
winter production	insect and rodent control methods
figuring costs	Ginger grows in Kansas
cost-production	planting can be in a homemade small unit to see if it is worth it to me
marketing strategies	light availability at different times of the year
importance of record keeping	soil nutrition
varieties	develop a detailed plan to target a particular market
crop timing	plant more varieties of greens
reference information regarding programs and grants	put up a hoop house to extend season
investigate Daily light integral and GDU to estimate crop development	types of row cover
focus more on hardening off greens for extended harvest	improve my compost piles
	planting later for winter production of lettuce and spinach
	so much can be produced in winter!

9. What suggestions do you have for making this program more effective?

Make an annual event	something to drink besides coffee
Providing all support materials to all attendees to avoid having	rooms were too cold
to wait for them in the mail	have speaker repeat question during Q&A sessions
Larger venue (restrooms and seating and viewing presentations)	attract younger participants
Keep coffee pots filled	share email addresses of attendees
more physical activity	more Q&A times
more pictures in the slides	list of websites mentioned in presentations
get word out about conference sooner	speakers that run farms in our area
smaller sessions with more diversity offered	shorter day
possibly let companies/suppliers present	more short stretch breaks
afternoon presentations were weaker than morning	
bigger sign outside	

10. What topics would be of interest to you in future workshops?

No-till gardening	
High & Low tunnels	cooking with more exotic vegetables
cover crops	detailed info about specific crops
chinese greenhouses	pricing produce
drought and heat farming techniques and practices	farm and food gathering
egg production	tree fruits
lists of winter-hardy varieties	herbs
Mushroom production methods and most tolerant varieties	crops tested for this region
Compost composition of homemade	cover crops and rotations
Pesticides: conventional and organic methods	more on economics
Seeds: GMO vs organic	permaculture systems
Organic: detailed definition and processes involved to organically	water catch and hold systems
grow and certify organic	soil care
Crop planning for missouri	continued market gardening
labor issues/laws for market farms	all vegetable and flower production tips
hold a farm expo to market farmers to farmers markets	any dealings with growing and VAPs
invite Greg Carlos to speak about his operation and market	growing berries, fruits, vegetables and flowers
Plant/seed variety	companion planting
nuts and bolts on how to get started	natural insect control
resources to find markets (buyers and wholesale)	tomatoes—varieties, nutrition, disease, pests
Fruit production in tunnels	summer insect control of cucumber beetles and squash bugs
equipment info on what tools to purchase to make more profit	pumpkin and squash growing
what the customer is looking for	Strawberries—herbicides and weed control
CSA-info on how it works	blackberries and raspberries
making a profit with small-scale farming	how growers can COOP together
raising/marketing livestock on a small farm scale	processing local food
pest/insect control specific to the area	practical four-season growing/gardening/marketing
starting seeds and growing conditions for specific crops	soil maintenance
cheesemaking	pest control
keeping chickens	effective fertilization
soap making	smaller-scale conference for homeowner use (vice business/seller aspect)

Evaluation: Safe Production/Harvest Practices Workshop– Mountain Grove, MO – March 15, 2013

The information you provide will not be used to identify any program participants. You may refuse to answer any questions. Your answers to the following questions will help University of Missouri Extension make sure that we are presenting valuable programs to a wide range of participants and will aid in future planning and training improvements. We appreciate your time and input. Please circle or mark appropriate answer.

		Poor	Fair	Average	Good	Excellent
		1	2	3	4	5
1.	How would you rate the overall program?	0%	0%	0%	33%	67%
Average rating (1-5 Likert Scale)		**4.667**				

		Poor	Fair	Average	Good	Excellent
		1	2	3	4	5
2.	How well were your expectations met in this program?	0%	0%	0%	57%	43%
Average rating (1-5 Likert Scale)		**4.429**				

3. I would recommend this program to others.
YES 100%
NO 0%

4. Overall, after completing this workshop, do you think your knowledge gained of pest management and safe production practices has increased:

a geat deal	a moderate amount	a little	not at all
4	3	2	1
48%	52%	0%	0%
Average knowledge gain (1-4 Likert scale)		**3.476**	

Listed below are the topics presented during this workshop. On the left, circle your knowledge of each topic BEFORE the workshop. On the right, circle your knowledge of each topic AFTER the workshop.

How confident you are in using these practices or researching information after the workshop(percentage of respondents):

5.	Question:	Non-existent	minimal	moderate	considerable
		1	**2**	**3**	**4**
1	Good Agricultural Practices (GAP)	0	4.347826	34.78261	60.86957
2	Food safety concerns related to manure use	0	4.166667	33.33333	62.5
3	Strategies to deal with health and hygiene issues for workers	0	4.545455	27.27273	68.18182
4	Food safety practices for pick your own farms	0	4.545455	27.27273	68.18182
5	Food safety issues related to water use on the farm	0	4.166667	33.33333	62.5
6	Traceback	0	4.347826	30.43478	65.21739
7	Writing a food safety plan for the farm	0	8.333333	58.33333	33.33333
8	Food safety issues at farmers market	0	4.545455	31.81818	63.63636
9	Department of Health food handling regulations	0	12.5	41.66667	45.83333
10	Safe water use issues	0	8.333333	29.16667	62.5

Knowledge gain

	Question:	Pre Evaluation score	Post Evaluation score	Knowledge gain (1-4Likert Scale)
1	Good Agricultural Practices (GAP)	2.454545	3.565217	1.110672
2	Food safety concerns related to manure use	2.608696	3.583333	0.974638
3	Strategies to deal with health and hygiene issues for workers	2.695652	3.636364	0.940711
4	Food safety practices for pick your own farms	2.363636	3.636364	1.272727
5	Food safety issues related to water use on the farm	2.782609	3.583333	0.800725
6	Traceback	2.272727	3.608696	1.335968
7	Writing a food safety plan for the farm	1.904762	3.25	1.345238
8	Food safety issues at farmers market	2.5	3.590909	1.090909
9	Department of Health food handling regulations	2.458333	3.333333	0.875
10	Safe water use issues	2.75	3.541667	0.791667
	Average knowledge gain			**1.054**

6. Please comment on the presenter's skills so that we can improve.

Did presenters encourage questions? Keep me focused and interested? Did the presenters use clear examples? Were they well-prepared?

- Yes.
- It was wonderful.
- Yes
- Yes to all questions. Did a very good job.
- Yes to all.
- All presenters were extremely knowledgeable, encouraged questions.
- Excellent.
- Yes
- Yes, excellent.
- All speakers were excellent.
- Yes, they encouraged questions. Health man – did great job.

7. What will you do differently as a result of this program (percentage of respondents)?

	Did Before Workshop	*Plan to Do in Next 6 Months*	*No Plans to Use this in My Operation*	*Does Not Apply in My Operation*
Write a farm food safety plan for my farm	10.52631579	68.42105263	21.05263158	0
Test my water source for contamination	10	60	20	10

	42.10526316	47.36842105	10.52631579	0
Test my soil				
	15	40	10	35
Change my use of manure				

8. What else did you learn that you plan to use this year?

- Came last year, knew most of it.
- Test the soil.
- General knowledge in regards to GAP and GHP
- How to make plan.
- Irrigation.
- So many things – they're all jumbled up but still useful.
- Crop protection water source that protect

9.What suggestions do you have for making this program more effective?

- Give more examples, make interesting. Health man did.
- Have listen ears.
- Go into detail about the rules in order to grow plants.
- Written handouts for reference.
- This will be first year farmers' market so I have no suggestions yet.
- Nada
- Maybe show examples of veggie/produce washing stations of different sizes and set-ups- worth more than 1000 words.

10. What topics would be of interest to you in future workshops?

- Gardening.
- Canning.
- How to grow grapes.

WebApps impact reporting

1. **Customer Quotes**

What did you learn that you plan to use this year?

- Came last year, knew most of it.
- Test the soil.
- General knowledge in regards to GAP and GHP
- How to make plan.
- Irrigation.
- So many things – they're all jumbled up but still useful.
- Crop protection water source that protect

2. **Learning (Short Term) Outcomes knowledge, skills or attitude change**

When asked to consider the program as a whole, the attendees who responded to the survey reported an average knowledge gain of **3.476** on a 1-4 Likert scale, with 4=great deal of knowledge gain. Attendees were surveyed on knowledge of workshop topics before and after the program, and average knowledge gain on a 1-4 Likert scale, with 4=considerable knowledge gain, was the following: Good Agricultural Practices (GAP), 1.111; Food safety concerns related to manure use, 0.975; Strategies to deal with health and hygiene issues for workers, 0.941; Food safety practices for pick your own farms, 1.273; Food safety issues related to water use on the farm, 0.801; Traceback, 1.336; Writing a food safety plan for the farm, 1.345; Food safety issues at farmers market, 1.091; Department of Health food handling regulations, 0.875; and Safe water use issues, 0.792. The overall knowledge gain was **1.054**. Following the program, attendees reported confidence in understanding these topics at a considerable level, 59%, moderate level, 35%, or minimal level, 6%.

The attendees who responded to the survey were asked to describe behavior change as a result of the program. The following actions were planned within the next 6 months: write a farm food safety plan for my farm, 68% of attendees, test my water source for contamination, 60%; test my soil, 47%; and change my use of manure, 40%.

3. **Customer satisfaction exit survey or comments about the learning experience**

The attendees who responded to the survey rated the overall program as **4.667** on a 1 to 5 Likert scale, with 5=excellent. Attendees reported that expectations were met in the program at a level of **4.429** on a 1 to 5 Likert scale, with 5=excellent. **100%** of attendees reported that they would recommend the program to others.

Please comment on the presenter's skills so that we can improve.

Did presenters encourage questions? Keep me focused and interested? Did the presenters use clear examples? Were they well-prepared?

- Yes.
- It was wonderful.
- Yes
- Yes to all questions. Did a very good job.
- Yes to all.
- All presenters were extremely knowledgeable, encouraged questions.
- Excellent.
- Yes
- Yes, excellent.
- All speakers were excellent.
- Yes, they encouraged questions. Health man – did great job.

What suggestions do you have for making this program more effective?

- Give more examples, make interesting. Health man did.
- Have listen ears.
- Go into detail about the rules in order to grow plants.
- Written handouts for reference.
- This will be first year farmers' market so I have no suggestions yet.
- Nada
- Maybe show examples of veggie/produce washing stations of different sizes and set-ups- worth more than 1000 words.

Project 13: Increasing Education and Consumption of Organic Vegetables in a Food Desert Community with a Focus on Organic Pest Control and Food Safety

EarthDance
Molly Rockamann
Final Performance Report

Project Summary

Five years ago, EarthDance began an Organic Farming Apprenticeship program on the historic Mueller Organic Farm in Ferguson, Missouri as a way to meet the ever-increasing demand for locally and organically grown foods. In the past five years, EarthDance's programming has grown in scope and impact, and 116 beginning farmers have received training through our apprenticeship program. EarthDance is currently in the process of collecting results of an alumni survey, in order to better gauge the impact of the program on these graduates. We know of at least nine graduates who engaged in full- or part-time commercial farming in the last two years, and at least seven more who launched garden-related community projects. Others are employed in supportive roles, such as marketing local foods or managing farmers markets. Many more are growing food for their own consumption, and to share with family and neighbors.

Our 2013 Specialty Crop Block Grant Project focused on increasing the skills and knowledge of beginning organic farmers by further developing EarthDance's Organic Farming Apprenticeship Program. We also educated area farmers on issues related to food safety, post-harvest handling techniques, and organic pest and disease management. EarthDance recruited more low-income and minority individuals to our apprenticeship program, in order to teach them a marketable job skill in sustainable agriculture and increase production of specialty crops in Missouri.

Two common obstacles to success in marketing local, organic food are managing pest and disease issues, and lacking understanding or tools to ensure best practices in postharvest handling. To address the first issue, EarthDance hosted a field day workshop to discuss and showcase techniques and emerging trends in controlling pests and diseases on an organic farm. EarthDance sought to address the challenges of postharvest handling for other farmers by demonstrating a low-cost option for cold storage: building a walk-in cooler, using "cool-bot" technology. After completing our cool-bot, EarthDance conducted a workshop for other farmers on improving post-harvest handling techniques and incorporating a cool-bot.

The main objectives of the project were to:

1. Increase the number and diversity of low-income individuals who participate in the Organic Farming Apprenticeship program through the offerings of scholarship opportunities.
2. Develop a more comprehensive curriculum and experiential education plan for the EarthDance Organic Farming Apprenticeship program.
3. Conduct field days on post-harvest handling techniques, food safety, and organic pest and disease management for small-scale vegetable growers in the region.

This project was an expansion upon a project titled "Educating from Seed to Market: Sustainable Heirloom Tomato & Lettuce Production as Training for Beginner Farmers," which was funded by the MO Department of Agriculture's 2009 Specialty Crop Block Grant Program. That project educated 21 beginning farmers in the Organic Farming Apprenticeship program over a 9-month period, created a Community Supported Agriculture (CSA) Distribution Model and a crop preservation workshop, and created a partnership with various community organizations to promote healthy living and local foods. Through this project, EarthDance sought to recruit more low-income apprentices, and educate area farmers in subjects related to food safety and organic pest and disease management.

Project Approach

This project began with the recruitment of beginning farmers for the 2013 farming season. We sought to attract 25 apprentices but fell short by one, for a total of 24. We sought to compose a racially and economically diverse class of apprentices (20% minorities and 20% low-income). Ultimately, 17% of the 2013 class was African-American or Hispanic. There was a greater than expected need among applicants for financial assistance; 42% of apprentices (10 total) were awarded need-based full or partial scholarships.

In February, EarthDance staff constructed a walk-in cooler for improved food safety and to demonstrate a low-cost option for cold storage to apprentices and other farmers. On April 22, 2013, EarthDance hosted a "Food Safety Management and Post-Harvest Handling Techniques" workshop for area farmers, in which we featured our methods of constructing a walk-in cooler using Cool-Bot technology. Thirty beginning farmers were present to learn about cool-bot construction, food safety concerns for farming production, and best practices for harvesting and storage techniques. From the 30 attendees, we collected 22 evaluations. The vast majority of the responses indicated that they agreed or strongly agreed that the demonstration/discussion of the walk-in cooler construction (see pictures at the end of this document and link to YouTube for a time-lapse video of the construction) provided useful information. It was indicated that the Food Safety component was a little too technical, but still valuable information. A follow up survey was held six months later in October 2013.

The Organic Pest and Disease Management Field Day for farmers, (with a workshop on organic pest and disease control) was the next step in the project; taking place on August 8, 2013. Curriculum for this class was designed by our EarthDance Farm Manager. His presentation included a review of the disease triangle concept of plant pathology and a "show and tell session" with field walk showcasing different facets of Integrated Pest Management (IPM) practiced at EarthDance, including physical, biological, and chemical controls, such as use of kaolin clay and row cover, strategies to attract beneficial insects, as well as insecticidal soap and bT. He also discussed various types of OMRI approved pesticides used at EarthDance, and the safety implications of these applications for human and ecosystem health.

The class concluded with a scavenger hunt to identify several agricultural pests. At the field day, we also distributed a copy of the SARE book "Resource Guide for Organic Insect and Disease Management" to all attendees. The number of participants was 22 out of the 25 we anticipated. However, our follow-up survey about the class indicated that it had been an effective session: 86% of respondents said that they gained a significant understanding of the disease triangle approach to pest/ disease management, and 14% said that they gained some understanding. The majority also reported that they gained understanding of the following approaches: using row cover to deter pests, planting cover crops and flowering plants to attract beneficial insects, selecting disease-resistant crop varieties, and careful use of organic-approved pesticides. Also, 86% described the Resource Guide as "Very helpful," and 14% described it as "Somewhat helpful."

As a result of the feedback from the Organic Pest and Disease Management Field Day and workshop, we will be implementing some changes into the 2014 curriculum. That feedback indicated that separating the information into two workshops, one dedicated to organic approved pest products and the other to implementing cultural and physical controls would be helpful.

The final evaluation was the last step of the project done in October 2013. The evaluation asked apprentices to assess the educational value of the program's components, including enrichment sessions, field trips to other farms, field work, farmers' market training, and the CSA. The feedback will contribute to our curriculum planning for 2014.

The project partners were North County Technical School and St. Stevens Episcopal Church. North County Technical School provides both the greenhouse space and classroom space for the Organic Farming Apprentices and other area farmers to be able to get hands on experience, and practical information when computers, projectors and other electronic means are used to educate. The greenhouse space is adequate and offers area to seed and propagate plants in a controlled environment and show the beginning farmers what items are needed and how to use them. Classroom space is given both by North County Technical School for the Food Safety Management and Post-Harvest Handling Techniques workshop as well as other enrichment sessions. St. Stevens Episcopal Church hosted the apprenticeship orientation and potluck on February 17, 2013, and has since provided classroom space for two of our enrichment sessions.

Goals & Outcomes Achieved

Activity: Recruitment of low-income individuals to the Organic Farming Apprenticeship program through e-marketing, information sessions, flyers, and community organizations.

Recruitment for the 2013 apprenticeship program began September, 2012. From September to December 2012, our Farm and Community Education Coordinator, attended at least 10 community events to recruit potential apprentices, and the program was featured in countless e-newsletters, blogs, and social media platforms. We have disbursed flyers and other promotional materials in at least 30 different locations. Our goal for number of applicants was 25; the program commenced in March with 24 participants.

Performance Measure Goals: Number of apprentice applicants who qualify for a scholarship on a need-based level. (Target = 20% of 25 apprentices = 5). **Results:** We awarded 10 scholarships out of 24 apprentices. Five apprentices received the scholarships awarded by the Specialty Crop Block Grant Program. Our percentage of applicants with a financial need was greater than predicted, with almost 48% of applicants indicating a financial need.

Performance Measure Goals: Number of apprentice applicants who are minorities (Target = 20% of 25 apprentices = 5). **Results:** Of the 24 participants for our 2013 class of apprentices, four were minorities, which is 17% of participants.

Problems and Delays: The most significant challenge during this project was recruitment of apprentices. We started the 2012 season with 26 apprentices. We therefore set a goal and expectation of 25 apprentices based off our previous experience in gaining a set number of participants. However, it was more challenging than anticipated for us to meet that goal. To address this, our Farm and Community Educator Coordinator, as well as the rest of the EarthDance staff, worked diligently to promote EarthDance and the apprenticeship program at every opportunity, through community events and electronic means. Although we came very close to our goal, we began the season on March 4, 2013 with 24 apprentices. It was also a challenge to recruit minority beginning farmers for the program. We greatly want to increase our diversity in the apprenticeship program, and therefore aimed to have 20% of the class a minority apprentice. We fell short of that goal with 17% of the class a minority. However, we still have more minorities in this class of apprentices than we did last year, which is an accomplishment by our measures.

Attrition of participants remained a challenge in 2013; of the 24 apprentices that started the season, 16 completed the program. After several years of observing this trend, EarthDance staff members have chosen to reduce the duration of the program from 8 to 5.5 months. In 2014, the program will begin in late April and conclude in early October. We believe that this timeline will better suit the needs of our adult learners who struggle to fit the 9.5 hour per week commitment into their busy schedules. This has meant carefully analyzing our curriculum in order to provide a comprehensive introduction to small farm operation during the shorter program.

- We believe our measurable outcomes were realistic and attainable, and were almost attained.
- We believe a target of 25 apprentices is attainable, and will use that as a target for the 2014 class of apprentices. We also believe that our goal of 20% minorities is reachable with more outreach to our neighbors and community organizations.

Activity: Create the season's crop plan; refine curriculum development. Host weekly enrichment sessions; Guide field work for Apprentices.

- The 2013 Crop Plan was drafted beginning in December, 2012.

- Curriculum development began in July, 2012, after the 2012 Mid-apprenticeship Feedback Form was submitted by the 2012 apprentices. Based on their feedback, certain aspects of the curriculum were altered or replaced with more appropriate material.
- Greenhouse work began February 4, 2013 with current and past apprentices assisting, and weekly enrichment sessions began March 4, 2013.
- Orientation for the 2013 apprenticeship program took place on February 17, 2013. The 24 apprentices enrolled in the program attended their first enrichment session on March 4, 2013, which consisted of introductions, a name recognition activity, and concluded with a tour of the farm and office facilities. Fieldwork began the following week on March 10, 2013. In 2013 apprentices worked a total of 8 hours in the field per week, with a choice of seven four-hour shifts available per week to meet those hours. An average of seven apprentices worked each field shift.
- **Performance Measure*:*** Engage 25 beginning farmers (apprentices) in 264 hours of fieldwork, farmers market, and CSA education, 60 hours of enrichment sessions and field walks, and the opportunity to visit at least 8 other local farms. **Results:** We fell short of our goal of number of beginning farmers trained by one, with 24 apprentices enrolled in our first-year apprenticeship program. By the end of the project, at least 16 apprentices completed 264 hours of fieldwork each. EarthDance provided market training at 26 markets, hosted 60 hours of enrichment programming, and guided 8 trips to local farms.

Activity: Construction of the walk-in cooler began in Quarter 2, and was in use during Quarter 3 as vegetables were harvested and stored in the cooler.

- March 2013 saw the successful construction and completion of our walk-in cooler. That was in preparation for the Food Safety Management workshop held on April 22, 2013.
- While not a project partner, we received valuable volunteer service in the construction of the walk-in cooler. One board member, a volunteer, and two paid contractors were able to completely build and document the cooler construction within four days.

Activity: Food Safety Workshop for area farmers to discuss how to improve post-harvest handling techniques, with demonstration of a walk-in cooler using cool-bot technology.

- On April 22, 2013, EarthDance hosted a “Food Safety Management and Post-Harvest Handling Techniques” workshop for area farmers, in which we featured our methods of constructing a walk-in cooler using Cool-Bot technology. Thirty beginning farmers were present to learn about food safety concerns for farming production, and best practices for harvesting and storage techniques. Of the 30 attendees, 22 evaluations were received. The evaluations asked three questions per subject, for a total of six questions. The attendees were asked to rate the presentation using Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree for the following criteria:

    - The presentation was engaging and informative.
    - I learned valuable information about postharvest handling, which I will apply to current or future agricultural endeavors.
    - The presentation met my expectations based on the topic of the class.
    - Other feedback.

The vast majority of the responses indicated Agree or Strongly Agree; with many participants taking a lot of valuable information from the demonstration of the walk-in cooler construction (see pictures at the end of this document and link to YouTube for a time-lapse video of the construction). It was indicated that the Food Safety component was a little too technical for the stage of farming the attendees were currently at, but still valuable information for the future.

Performance Measure*:* Host a food safety/ cool-bot workshop for at least 25 farmers. Distribute a guide to postharvest handling and one for cool-bot construction to all participants. **Results*:*** We had 30 participants, surpassing our minimum goal.

- Grant partner North County Technical High School provided the classroom space for the "Food Safety Management and Post-Harvest Handling Techniques" class.

- We met our goal for the number of beginning farmer participants in our "Food Safety Management and Post-Harvest Handling Techniques" workshop. But in addition, we wanted to know if what they learned would be applied to their own agricultural operations. Therefore, a follow up survey was emailed to the participants six months after the workshop took place.

Problems and Delays

- The content of the workshop presented a challenge. It was a large amount of information to cover in short period of time (the workshop was an hour and a half), and the audience consisted of farmers of varying stages of growth and experience. So what was valuable information for one farmer was too advanced for the next farmer.
- We took the lessons learned regarding the content of the "Food Safety Management and Post-Harvest Handling Techniques" class and used that in the development of our "Organic Pest and Disease Management" class during Quarter 4. The presentation became more visual, more interactive, and less lecture-style.

Activity: Organic Pest & Disease Management Field Day was held for area farmers, with a workshop on organic pest and disease control.

Our field day on pest and disease control took place on August 8th, 2013. Curriculum for this class was designed by our Farm Manager. His presentation included a review of disease triangle concept of plant pathology and a "show and tell session" and field walk showcasing different facets of Integrated Pest Management (IPM) practiced at EarthDance, including physical, biological, and chemical controls, such as use of kaolin clay and row cover, strategies to attract beneficial insects, as well as insecticidal soap and BT. There was also discussion of the various types of OMRI approved pesticides used at EarthDance, and the safety implications of these applications for human and ecosystem health.

The class concluded with a scavenger hunt to identify several agricultural pests. At the field day, we also distributed a copy of the SARE book "Resource Guide for Organic Insect and Disease Management" to all attendees.

Performance Measures: Host a Pest and Disease Management workshop for at least 25 farmers. Distribute a guide on the same topic to all participants. Follow up with a survey to gauge effectiveness of the session. **Results:**

- Twenty-two beginning farmers and members of the public attended the session; this number fell slightly short of our goal of attracting at least 25 participants.
- Each attendee received a copy of SARE's Guide to Managing Pest & Disease
- Our follow-up survey about the class indicated that it had been an effective session: 86% of respondents said that they gained a significant understanding of the disease triangle approach to pest/ disease management, and 14% said that they gained some understanding.
- The majority also reported that they gained understanding of the following approaches: using row cover to deter pests, planting cover crops and flowering plants to attract beneficial insects, selecting disease-resistant crop varieties, and careful use of organic-approved pesticides.
- Also, 86% described the Resource Guide as "Very helpful," and 14% described it as "Somewhat helpful."

We also received the following feedback about how the class could have been more helpful: "it would be interesting to have two classes. One dedicated to organic approved pest products and another whole class dedicated to implementing cultural controls and physical controls. I feel like the former needed more attention in terms of when to apply what. The latter needed more attention overall, especially having whole farm cultural practices and how to apply them." We plan to incorporate this feedback into our planning for the 2014 sessions on pest and disease management.

Problems and Delays: The total number of participants in the workshop fell slightly short of our goal of attracting at least 25 participants.

Activity: Final evaluation of apprenticeship program; recruit new applicants.

Final Evaluation of the program took place in October of 2013. The evaluation asked apprentices to assess the educational value of the different program components, including enrichment sessions, field trips to other farms, field work, farmers' market training, and the CSA. The feedback will contribute to our curriculum planning for 2014.

Performance Measures: 1) Complete the creation, distribution, and evaluation of feedback forms collected throughout the apprenticeship, and at the conclusion of the program. **2)** Host two public info sessions to inform the public about the 2014 program; recruit apprentices through multiple channels of publicity, including door-to-door canvassing, handing out flyers, media outreach, and contact with local schools and universities. **Results:** EarthDance staff evaluates the conclusion of each year's program through a review of apprentice feedback forms, observations recorded by staff after each enrichment session, and by tracking the future plans of our graduating apprentices. In other areas of this report, we expand upon lessons learned from this process.

Based on the feedback we received from apprentices, we are confident that the program provides high-quality agricultural education. Here is a sampling of the responses to the question as to whether the program met, fell short of, or exceeded expectations:

- The program exceeded my expectations. I've appreciated the people I've had the privilege of working with, the shared appreciation and knowledge, the encouragement and passion, the helpful resources, and the wonderful delicious produce.

- Exceeded. I feel I have bridged the gap from gardening to farming, but have learned so much to supplement/augment my gardening practices.
- It exceeded expectations and a large part of that was the amount of time that was required. Completing the program having done all the work made it more enjoyable. Every member of the staff was helpful, knowledgeable, and positive. The hands-on experience is also invaluable, as were the farm walks and field trips.
- Exceeded. The farm managers were excellent! They really made the experience so fantastic. Friendly, knowledgeable, helpful, great educators.
- It met my expectations. I've appreciated working with such knowledgeable people and the patience they've had in teaching us all.
- The program exceeded my expectations in terms of getting an introduction to growing organically and doing it as part of a community effort.
- Exceeded. The comprehensive coverage of all topics related to farming business and way of life. Networking with other farmers, the ability to pick our Farm Manager's brains.

At least one of the members of the class of 2013 is already currently engaged in full-time commercial farming of specialty crops. Another 2013 apprentice began working on a farm in Hawaii at the end of 2013. Three apprentices have expressed their desire to return for a sophomore year with EarthDance. Finally, one other 2013 apprentice who previously gardened solely to feed her family has made plans to expand her growing operation and sell her surplus produce to restaurants.

Our recruitment for 2014 is underway. Currently, we have 20 applications, and we will continue recruitment through March 1st, our application deadline.

Problems and Delays: The evaluations indicated to us that the apprenticeship is serving a valuable educational role in the training of these aspiring growers. However, we experienced an attrition rate of about 40% by the conclusion of the program. Increases in job responsibility, health problems, and family emergencies were often responsible for an apprentice's decision to leave the program. We determined, after significant deliberation, that a shorter program would likely better meet the needs of the majority of participants in EarthDance's apprenticeship. For this reason, the 2014 apprenticeship will run from late April-early October. We are also actively engaged in curriculum adjustment to assure that though the program will encompass a shorter time, apprentices will still gain a comprehensive introduction to small farm operation. In addition, we plan to add more instruction in gardening, as a significant number of participants in the apprenticeship go on to pursue, at least in the short-term, smaller-scale projects.

Activity: Conduct a follow-up survey of participants in the Food Safety Management and Post-Harvest Handling Techniques to gauge effectiveness of the class.

Performance Measures: Create and conduct survey
Results:

- A total of 11 of the 26 attendees of the workshop on Food Safety Management and Post-Harvest Handling Techniques responded to three requests to complete the online survey.
- Of these respondents, four said that they were currently farming, and four reported that they are not yet farming, and two declined to answer the question.
- Of the group that are currently farming:
  - 10% reported that they had completed a food safety plan,
  - 30% had implemented changes to their postharvest handling practices, based on what they learned at the class, and none had built a cool-bot.

    - 60% of these respondents said they plan to do one of the above activities in the future.
- Of the respondents who are not currently farming:
    - 29% said that as they pursue agricultural enterprises in the future, they will create a food safety plan;
    - 57% plan to practice postharvest handling techniques that they learned in class
    - 14% plan to build a cool-bot.
- All of the respondents said that if they decided to add a walk-in cooler to a current or future farming operation, they would build a cool-bot, rather than purchasing a pre-fab cooler.
- Additionally, all of the respondents said they found both materials distributed at the class (a guide to postharvest handling techniques and a cool-bot construction manual) very helpful.
- Other feedback from the respondents included the following statements: "Very worthwhile session. Clear explanation of how to construct a well-insulated cool room that is economical to build and operate. Thank you so very much. Just what I needed!" and "Make sure you keep the two guides. They were valuable as ongoing reference."

If we can extrapolate that most non-responders to the survey had a similar perspective, the class was effective in conveying basic knowledge about food safety, post-harvest handling, and cool-bot construction. However, EarthDance's approach to teaching about these subjects in the future will probably be different; attendees of the class who were primarily interested in cool-bot construction likely would have benefited from a longer time-period devoted to this topic, and more hands-on interaction with the materials and techniques involved in the construction. We plan to teach post-harvest handling during field instruction in 2014, to provide more contexts to this information.

Problems and Delays: The survey had a somewhat lower response rate than we would have hoped, but it did have a 50% participation rate.

Beneficiaries

Primarily the beneficiaries were the Organic Farming Apprentices with some other local farmers that participated in the Food Safety Workshop, Cool-bot Workshop and the Organic Pest and Disease Management Field Walk. There were a total of 22 attendees for the Organic Pest and Disease Management Field Walk. For the Food Safety Management and Post Handling Techniques Workshop including methods of how to construct a walk in cooler using Cool-bot technology there were 30 attendees. Additionally, the knowledge that was acquired during this project is now available to the public, so other farmers can continue to benefit from the activities of this grant.

It will take longer-term evaluation to gauge the economic impact of our Specialty Crop Block Grant Project. However, we know that at least two of the participants in the 2013 class are currently engaged in full-time commercial farming of specialty crops. At least three others plan to grow for income within the next two years. The majority of the other graduates intend to grow food at home or in the community, providing economic benefit to themselves, their families, and others that consume nutritious food at a fraction of the cost of purchasing it.

Lessons Learned

The most significant lesson we learned from this project related to the value of Cool-bot technology for small farms on a tight budget. The construction of the walk-in cooler and Cool-bot was far less expensive than a purchased pre-fab walk-in cooler, and it has vastly improved our postharvest handling practices. Previous to the construction of the cool-bot at EarthDance, we trained our apprentice farmers to keep freshly harvested produce on ice, in large coolers. This necessitated ice pick-ups before each harvest, from a nearby school's ice machine. We recognized that most farmers would not be able to emulate this circumstance. The walk-in cooler is more effective at keeping the produce a steady temperature, and eliminating the frequent ice pick-ups has increased the efficiency of our harvest routine. We plan to continue sharing the materials we created in support of our workshop (a time-lapse construction video and step-by-step instruction manual), and we hope this will enable many more farmers to benefit from Cool-bot technology.

Another lesson learned through this grant project is the value of differentiated instruction for farmers at varying stages of their agricultural careers. Many of the participants in our workshops were beginning farmers who felt overwhelmed by the technical information in the food safety and Cool-bot workshop. Since many do not yet have farmland, they do not know what infrastructure they will need when they begin their own operation. To better tailor the pest and disease workshop to our participants with less farming experience, we designed this session to be more interactive, more visual, and with fewer lectures. Participants responded positively to this approach. Still, a separate session, targeted toward more experienced farmers might have attracted a different crowd, who are in a position to implement, in the near term, more of the practices we taught.

In terms of lessons pertinent to EarthDance's goal of recruiting more minority participants to the program, we are eager to build upon what we learned from our recruitment efforts of 2012-2013. The Ferguson-Florissant School District is a promising source of contact with African-American constituents, and we will continue to seek opportunities to connect to this audience. Additionally, EarthDance recently resolved to engage in the time-intensive but hopefully fruitful strategy of direct contact with the farm's immediate neighbors, through door-to-door canvassing. The farm's immediate neighbors are predominately African-American and low-income. Many of these individuals are hard to reach by means that we have traditionally relied upon for recruitment, largely through the Internet, and outreach at public events outside of Ferguson. We have already recruited one candidate for the 2014 apprenticeship from a street adjoining the farm. We understand that to significantly increase our neighbors' participation in programming at the farm, we will need to regularly reach out in person, through low-tech means, and by building relationships through casual interactions. We plan to host several on-farm events in 2014 that will be free to neighbors, encouraging these new connections that we hope will result in opportunities for our farm neighbors to benefit from our farm and garden educational programming. Additionally, we recently learned that a grant proposal to provide stipends to provide summer jobs to neighborhood teens was successful! We believe this will be one of the most direct routes to developing a pool of minority aspiring farmers.

We know that there is a keen interest in part-time farming education for urban dwellers, but we consistently find that concern about the time commitment involved in our program holds individuals back from pursuing this education. After observing the challenge of recruiting the number of apprentices that we hope to reach, and experiencing high rates of apprentice attrition (in spite of all participants reporting that they found the program highly educational and

enjoyable) we have decided that a shorter program is needed. As a result, the 2014 apprenticeship will take place over five and a half months, rather than eight. We are working diligently to design a curriculum that will provide a comprehensive introduction to small farm operation in the shorter time frame.

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Additional Information

Link for resource guide for organic insect and disease management written by Cornell University

http://web.pppmb.cals.cornell.edu/resourceguide/

Instructor Discussing Food Safety

Instructor discussing the construction of the walk-in cooler

Model of the Interior Construction for the Walk-In Cooler

Link to YouTube for a time-lapse video of the construction of the cool-bot

http://www.youtube.com/watch?v=IsFNCiYjqB8

How to Build a Walk-in Cooler using a Coolbot

Terms and Notes

- Project accessibility: Some familiarity with carpentry and electrical competence is necessary. Please read the entire guide and watch video to determine if you will need assistance from a professional carpenter or electrician.
- The time lapse video: http://www.youtube.com/watch?v=lsFNCiYjqB8&feature=youtu.be
- This guide assumes a level floor.
- Having drainage in your cooler is optional. Without drainage you can anticipate having to mop out your floor. If installing drainage, make sure you can close off it off to prevent air from escaping/entering from the outside.
- *Sidewall* refers to the two longer sides of the walk-in cooler
- *Endwall* refers to the cooler's two short sides
- Hammer/ Nail Gun: This project will be significantly easier to accomplish if you use a nail gun, as opposed to a hammer, to secure the framing.
- A 2x4 actually measures 1.5" x 3.5"

Resources

Official Coolbot Website: http://www.storeitcold.com/
Buy the actual Coolbot here. Also, you will need to consult the Coolbot website to determine which AC unit you should choose. The site has lots of other helpful info, including FAQs, construction tips and links to other construction guides, if you would like to consult multiple sources.

When choosing the size use the below link to determine what is appropriate given the size of your A/C unit:
http://www.storeitcold.com/sizebrand.html

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Materials

Quantity	Item	Notes	Cost
20	sheets of 4'x8' 2" "poly-iso" board-	Roofing supply companies such as abc supply are the only place to get this stuff. I think it is about $27ea. If you want to finish the exterior of the cooler at a later date, you would only need 14 sheets	$27 ea.
38	-2"x4"x8' studs Home depot		$2.67ea
2	2"x4"x8' treated stud		$2.97ea.
2	2"x4"x10' treated stud home depot	You may have to get a 12' board. I don't know if they have 10'. Home Depot	12' $6.27ea
2	2"x4"x10 stud home depot		$4.09ea.
6	4'x8' 2" pink foam board		$29
3	1/2 inch 4'x8' OSB with tongue groove		$18.97 ea
12-	-4'x8' 1/4" sanded plywood	This will be the final layer that you will paint. It doesn't have to be 1/4". I think they have some 15/32" that is actually cheaper. You do want sanded so it will be smooth after you paint it and you can clean it. home depot 15/32"	$18.47ea
5	boxes 4" screws		$9ea
1	pack of plastic shims		$1.85
1	insulated door with jamb	-this will be an exterior door. I think I bought mine at home depot for around $100. I think they come in two widths and I got the widest.	$100
1	floor drain materials		$28
7	4'x8' sheets drywall or plywood for		$13.23 ea

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	exterior-		
1	can of Great Stuff foam		$5.98
1	tube white caulk		$2.78
1	white gloss paint for the interior		$26.96
1	roll of vinyl flooring and adhesive		$7.38 sq yd
5	strips of quarter round (trim for floor)		$3.50 ea.
1	Light fixture for inside the cooler	It has to be covered for health dept. purposes.	$7.88
1	Misc. electric supplies for the light fixture and the AC unit	3 handy boxes, 1 octagon box, wire, outles switches, outlet plates, clamps	$40
1	roll of foil tape/insulation tape		$11.98
1	Coolbot		$299
1	15,000 btu window ac unit	Coolbot website lists brands that work/ don't work with the coolbot. http://www.storeitcold.com/sizebrand.html	$399 (for a new GE Brand 15.000btu A/C unit from Home Depot)

Total Materials Cost: *approximately* ***$2200***

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Step-by-Step Instructions

1 Measure four 2x4s to size to create your first wall frame. A pressure-treated 2x4 (which is 1.5" high) will serve as the baseboard. A non-treated 2x4 will top each frame. The bottom board will sit on its widest side against the floor. The top board will be in the same position. Each frame will have 2 vertical sideboards.
2 Repeat step 1 three more times to create four frame walls.
3 Nail the corners of each of your square frames together.
4 Measure your studs to fit between the base and top of the frame. All of your remaining 2x4s will serve as the studs. (When you install each stud, make a 4" mark along the floor and ceiling (if the ceiling is easily accessed) so you know where that stud is once it's covered up by the insulation. You'll need to screw into that stud later.)
5 On the top of both sidewall frames, measure and mark 5.5" from the end. This is where the first vertical stud will be placed. We measured 5.5" out to accommodate the 3.5" of the adjoining endwall frame and the 2" of foam that will be attached to the interior of the endwall frame.
6 Nail in the vertical stud at that 5.5" line
7 Measure 24'' from the 5.5'' mark and insert another stud centered on that mark. Add a stud every 24" continuing to center each stud at the mark. (This choice of 24'' is based off the grey insulation board coming prefabricated at 48'' inches. By putting studs at 24'' we can screw the insulation from both sides into the single stud.)

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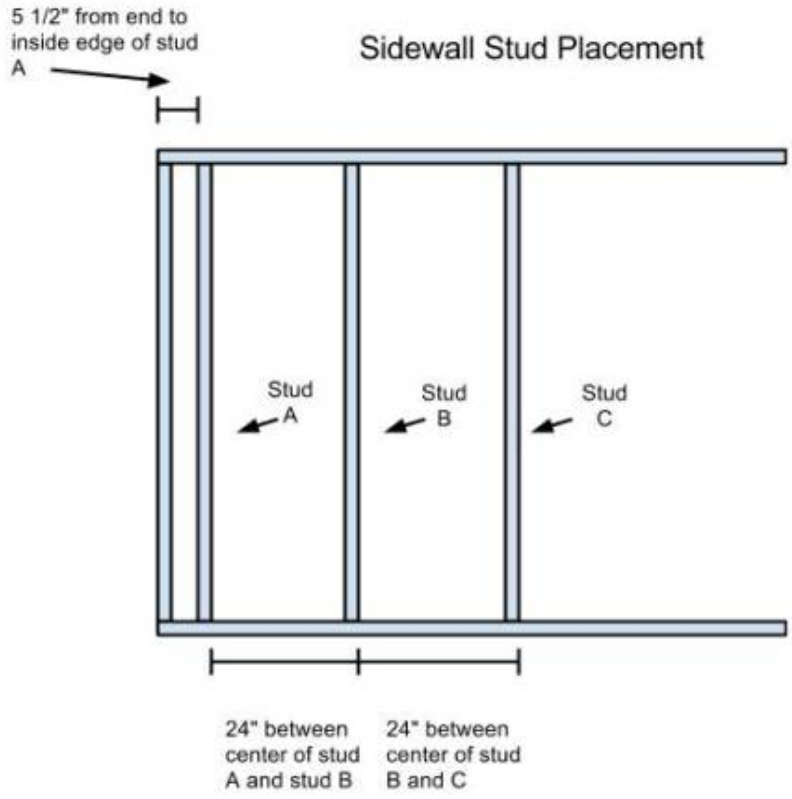

8 Make an identical frame with studs for opposite side
9 For the third side you must measure your A/C unit before deciding where to put your studs
10 A stud can go in at the 48" mark from the corner. From there you'll put in another stud which corresponds to the width of the the A/C unit. (Once vertical, mark and specially identify that spot on the ceiling to know where this stud is for screwing it in later. If you fail to mark the spot, you won't know where the stud is after you've attached the poly-iso board.
11 Cut out 2 pieces of 2x4 to serve as top and bottom framing of the A/C unit. Check to make sure they are level before screwing them into the studs. The bottom frame support for the A/C unit will need a vertical support 2x4 which will run from the floorboard to the bottom of the A/C frame support.

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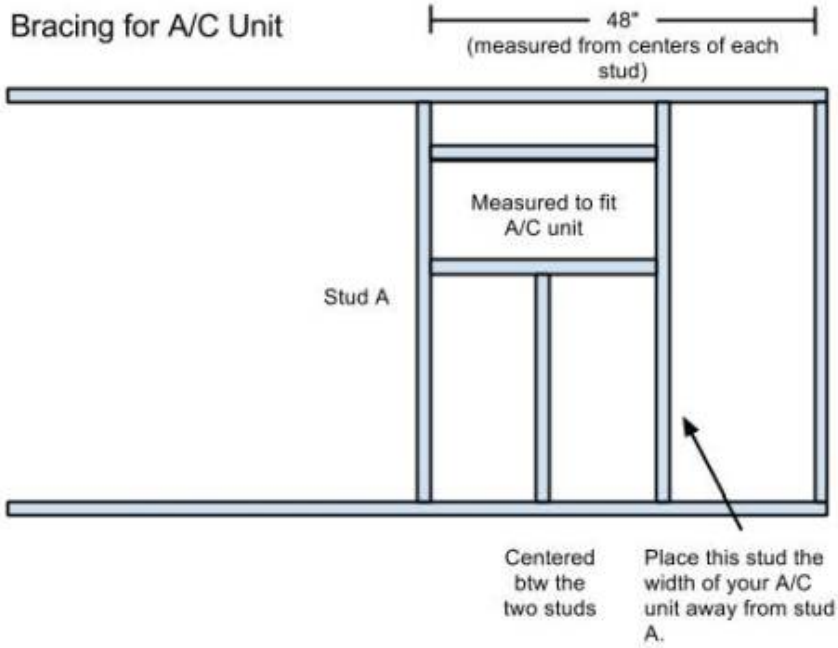
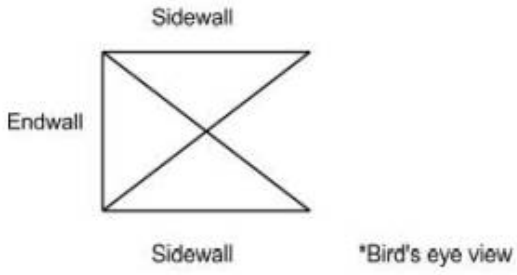


12 For the other half of the frame where you put the A/C unit in, you can put the stud at 24" inches from the middle stud at 48".

13 Now with 3 sides finished you can stand up the walls and nail them together. Use a level to make sure that your frame is vertically level before screwing the sides together. You can also ensure that the walls are square by measuring the two diagonals across the floor. Your three walls will be square to each other when the two diagonal measures are equal, as in the drawing below:



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14 Measure the width of the door and create a frame with 2 side-by-side 2x4s to go in the 4th frame.
15 Raise up 4th frame and nail into the other frames
16 Screw all frames into ceiling and floor
17 Attach any necessary electrical parts (outlet for A/C and coolbot and light fixture & switch).
18 Put the drainage pipe in place along the floor. Once you know where this will go you can mark it along 2x4 floorboard and remove. Then you can use those marks as a guide for where to cut out a piece on the bottom of the interior and exterior insulation pieces
19 Place all of the exterior insulation pieces against frame and trace out any pieces that will need to be cut out. ie: the A/C unit and electrical. (Depending on how many sides of an existing wall you're putting this against you'll need to screw on exterior insulation pieces prior to screwing the frames in place)
20 If insulation pieces are too tall, cut those down to the height of your cooler.
21 Cut out necessary holes with exacto knife.
22 Before screwing in the exterior insulation, make sure you've made a mark on the ceiling or vertical board to know where the stud is that you're screwing into.
23 Screw in all exterior insulation pieces with 4'' screws and washers. Be careful not to push the washer through the fiberglass cover of the insulation
24 Screw in all interior insulation pieces including the ceiling.
25 Use aluminum tape to cover up all creases.
26 Put down 2 layers of pink impermeable insulation for the floor. Cover up the creases on the bottom row by starting on a different side of the floor for the 2nd layer.
27 Cut out a hole in flooring and drop in the drainage tube. Make sure the mouth of the drain sits 1/2" above the insulation piece so it is flush and even when the floor is laid on top.
28 Caulk the space around the drainage tube.
29 Use insulation tape to cover all creases throughout the interior of the cooler.
30 Use caulk to fill in any creases that are wider than a millimeter or two.
31 Make sure all plywood pieces have a sanded side so they can be painted and cleaned later.
32 Screw plywood (sanded side on inside) pieces over the interior insulation pieces. Try to avoid putting screws in the same spot you screwed the insulation to the frame/studs.
33 Unscrew the skeletal frame of the A/C unit and then screw it into the frame.
34 Place A/C unit inside its skeleton.
35 Caulk all creases around the A/C unit and door to ensure no holes exist.
36 Paint the interior with a high gloss paint.
37 Paint your cooler as desired.
38 Lay vinyl floor.

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Project 14: Training Vocational Agriculture Instructors in Integrated Pest Management for Insect and Disease Problems in Ornamental Plants

Missouri Department of Agriculture
Anastasia Becker
Final Performance Report

Project Summary

Insects and diseases are the primary pest problems, and sometimes the hardest to identify, that commercial growers of ornamental plants face while producing various specialty crops in their greenhouses or nurseries. Accurate identification of pests and up-to-date information of available prevention and management strategies are essential components of integrated pest management (IPM) and sustainable production. For educators, both Extension and Vocational Agriculture instructors in our public schools, it is helpful to recognize which disease and insect issues to expect and the timing of them. Understanding appropriate measures to take, including responsible use of pesticides on these specialty crops, is essential to prevent problems and to manage them once they occur.

This project expanded training for an Extension educator workshop to include a new key audience, Vocational Agriculture instructors. The workshop's purpose was to provide up-to-date information on integrated pest management (IPM) for insects and diseases for ornamental plants including those found in nurseries and greenhouses. Emphasis was on identifying problems and developing sound preventative or control measures. The agriculture instructors are expected to incorporate best management practices into their curricula as they train students in their high school classes. SCBG funds expanded the new Extension continuing education workshop, "Sustainable Management of Insect and Disease Pests of Ornamental Plants in Missouri," to include another audience, the Vocational Agriculture instructors. SCBG funds also augmented the program by contributing to travel expenses so a regional expert in greenhouse and ornamental crops could speak. University Extension funds covered the Extension attendees while SCBG funds covered the Vocational Agriculture instructor attendees. This project was a new educational offering and did not build on previously funded Missouri SCBG projects.

Project Approach

There are limited opportunities for Vocational Agriculture instructors to attend workshops emphasizing IPM and sustainable management of insect and disease pests of horticultural crops. The primary objective of this project was to include up to 20 Vocational Agriculture instructors, a new audience, at an already planned 2-day Extension educator workshop featuring up-to-date information on IPM and sustainable management of insects and diseases of ornamental plants and greenhouse crops. The workshop was a new topic for a train-the-trainer offering, both for Extension educators and Vocational Agriculture instructors.

Many Vocational Agriculture instructors at high schools currently include horticulture topics in their agriculture classes and utilize on-site greenhouses as teaching tools for class and club activities, for example, producing vegetable transplants or poinsettias for sale. These teachers train many students and frequently their FFA students implement an independent Supervised Agriculture Project, often growing a specialty crop, so they will be able to apply information about IPM practices to their projects. These specialty crop projects also train students in business principles and represent a way to enter the agriculture profession with a minimum amount of acreage.

Another objective will be to determine how the Vocational Agriculture instructors are incorporating insect and disease IPM for specialty crops into their curricula. Changes in behavior will be evaluated by using a follow-up survey or interview in January 2016 to see how the information that participants learned has been utilized in classroom and teaching activities, especially those that pertain to the production of horticultural crops.

The main project activity was to conduct a 2-day workshop on insect and disease management with IPM practices for specialty crops. Eighteen Vocational Agriculture instructors joined about 30 Extension educators for the workshop. Reference materials including an insect identification book were supplied to the Vocational Agriculture instructors. All attendees completed a pre- and post-workshop questionnaire; a follow-up survey will be done in January 2016 to determine how the workshop information is being incorporated into their curricula.

Both of the target audiences benefitted from discovering challenges they face in educating their respective audiences. Future collaborative activities were also discussed by several of them. Recommendations from both audience sectors were to have additional workshops that included both of them since they all qualify for train-the-trainer offerings.

In the evaluation of the workshop, all of the respondents either agreed or strongly agreed that they increased their overall knowledge about IPM practices for ornamental plant pests and that they would incorporate some of the information learned into their educational programs. Evaluations were from the entire audience and were not separated into Vocational Agriculture instructors or Extension educators.

Project partners were several University of Missouri Extension Horticulture Specialists and the Lincoln University Extension IPM Specialist. These partners, together with the Missouri Department of Agriculture IPM Program, organized the workshop including speaker arrangements, gathered educational materials and tools, and oversaw the local arrangements for the event. The university partners got separate funding for the extension attendees while SCBG funds only covered the Vocational Agriculture instructors.

Goals and Outcomes Achieved

Measurable Outcomes and Achievements

- Increase the number of Vocational Agriculture instructors who have training in insect and disease identification for greenhouse production of ornamentals and vegetable transplants (goal). Target is to have 20 instructors attend training. This is a new professional development opportunity offered through Extension so the benchmark is unknown. The performance measure will be the number of Vocational Agriculture instructors attending the training.

    - Results: 19 Vocational Agriculture instructors signed up for the 20 available slots in the workshop although 1 had to drop out at the last minute so 18 attended.
- Increase Vocational Agriculture instructors' understanding of environmentally friendly IPM practices to manage insects and diseases in specialty crops (goal). Seventy-five percent of the Vocational Agriculture instructors attending will increase their knowledge of IPM practices by 33% or more (target) which will be measured through a pre-test and post-test (performance measure). The results of the pre-test will set the benchmark.
    - Results: All attendees were surveyed both prior to and after the workshop about their knowledge of the topics that would be presented. Combined results across all subjects showed that all attendees increased their knowledge during the workshop. On the "before" survey 17% indicated no knowledge, 39% indicated they had little knowledge and 34% had some knowledge about the workshop topics. Afterwards, 21% had some knowledge while 57% felt knowledgeable and 18% felt very knowledgeable. An attached spreadsheet has comparisons of the "before and after" responses.
- Participants will increase the amount of insect and disease IPM topics that they include in their curricula (goal) for their students by 50% or more (target). Responses from several pre-workshop questions will establish the benchmark and a detailed follow-up survey or interview (performance measure) will be conducted in 6 months to determine increases in the activities that include effective ways to manage pests with IPM for specialty crops.
    - Results: Six-month follow-up surveys will be sent to the Vocational Agriculture instructors in January 2016 asking additional details about how they are using the training.
    - Results: All of the workshop attendees either agreed (22%) or strongly agreed (78%) that they will use some of the information from the workshop in their educational programming, according to the post-workshop questionnaire.

Beneficiaries

Eighteen Vocational Agriculture Instructors attended the training. Instructors chosen for the training have on-site greenhouses as teaching tools for class and club activities, teach sections in fruit and vegetables during their coursework, or their students have independent specialty crop-oriented Supervised Agriculture Projects. These teachers train many students and they will be able to apply information about IPM practices to their projects. These specialty crop projects also train students in business principles and represent a way to enter the agriculture profession with a minimum amount of acreage. Indirect benefits will be the increase in confidence and business skills that the students will gain through the course of their Supervised Agriculture Project as they gain a broader understanding of the details involved in growing and marketing specialty crops.

Lessons Learned

Based on the positive comments during the workshop, the Vocational Agriculture instructors benefitted from the interactions with their Extension educator colleagues. Both groups are interested in additional opportunities to train together. It was more efficient to provide a mechanism to include an additional audience, the Vocational Agriculture instructors, at a workshop that was already planned than it would have been to have separately offered the same training to both. The stipends for the Vocational Agriculture instructors provided them the means to cover their travel expenses and made it possible for them to attend. Separate funding covered these expenses for the Extension educators.

This project also funded an additional expert speaker. Overall, the quality of the speakers received high marks with 35% very good and 50% excellent ratings. When asked if the workshop increased their overall knowledge about ornamental plants IPM 58% strongly agreed and 42% agreed.

More hands-on activities will be emphasized in future workshops on these topics.

Contact Person

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Additional Information

Event evaluation results are below. The 6-month follow-up survey will be sent out in January 2016.

ISE # 53 - Sustainable Management of Insects and Disease Pests of Ornamental Plants in Missouri

I. Evaluation of Topics

Please rate your degree of knowledge about each topic before and after listening to speakers:

Ratings:

1= No knowledge
2= Little knowledge
3= Some knowledge
4= Knowledgeable
5= Very knowledgeable

		Before					N/A	After				
Day	Topic	1	2	3	4	5		1	2	3	4	5
1	1. Invasive Insects Threatening Ornamental Crops in the Midwest (*Cloyd*)	4	11	15	6	0		0	0	4	24	8
1	2. Tree Disease Update (*Wright*)	7	13	12	3	1		0	1	7	24	4
1	3. Tree Insect Update (*Doerhoff*)	9	10	14	3	0		0	2	7	23	4
1	4. Pesticide Nuances (*Bailey*)	5	16	11	3	1		0	2	8	20	6
1	5. Overview of Reduced-risk Insecticides (*Cloyd*)	8	15	11	2	0	3	0	2	6	24	4
1	6. IPM for Roses (*Gauthier*)	9	14	6	3	1		0	4	10	12	7
2	7. Ornamental Plant Diagnostics - Signs and Symptoms (*Hosack*)	5	14	12	4	1		0	2	8	19	7
2	8. Disease Preventions and IPM for Perennial Plants (*Gauthier*)	4	13	15	2	5		0	1	8	19	8
2	9. Insect and Mite Management in Greenhouses (*Cloyd*)	4	15	15	2	0		0	0	5	21	10
2	10. Disease Prevention and Fungicide Programs in Greenhouses (*Gauthier*)	5	16	10	1	0	4	0	0	11	14	7
	Combined responses for each category of knowledge	60	137	121	29	9	7	0	14	74	200	65
	percentage of before (n=356) or after (n=353) ratings	17	39	34	8	3		0	4	21	57	18

II. Speaker Evaluation

Please evaluate the performance of each speaker using the following scale for giving your rating

Ratings:

1= Poor
2= Fair
3= Good
4= Very Good
5= Excellent

	1	2	3	4	5	unrated
Speaker						
Dr. Cloyd	0	0	0	11	25	
Mr. S. Wright	0	3	10	11	12	
Ms. R. Doerhoff	0	0	5	14	17	
Mr. P. Bailey	0	3	2	19	12	
Dr. N. Gauthier	0	0	3	11	21	1
Ms. P. Hosack	0	1	5	9	20	1

III. Overall Workshop Evaluation

Please rate the overall effectiveness of this IPM

	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
1. The topics of the workshop addressed my needs adequately	16	19	1	0	0	
2. This workshop increase my overall knowledge about Ornamental Plants IPM	21	15	0	0	0	
3. Overall, the performance of the presenters were good	21	15	0	0	0	
4. The method of presentations was adequate	18	14	2	2	0	
5. The table discussion with presenters during dinner (day 1) was useful	17	11	8	0	0	
6. The tour of the botanical garden was interesting	17	14	4	0	0	1
7. The facilities, arrangements and food were adequate	25	10	1	0	0	
8. This is a type of workshop that should be offered every 2-3 years	20	14	1	0	1	
9. I will use some of the information presented here in my educational programming	28	8	0	0	0	

Please write additional comments including any suggestions on how to improve this type of workshop in the future.

> Mr. Cloyd was awesome. Engaging and very useful info. More info about vegetable production would have been useful.
>
> I will use lots of the greenhouse pest info for my greenhouse management class this fall.
>
> IPM for roses was excellent.
>
> The insect control and pesticide information will be useful for school greenhouse. - thanks

Great experience! Thanks for hosting this event! I'm going to concentrate more on sanitation in the greenhouse.

I will change the way I recommend people treat EAB and other tree borers.

I will use this info in my master gardener training. I will also send some information to nursery/greenhouse growers.

High quality program. Engaging speakers. Definitely walked away with a lot of helpful information to more adequately answer client questions. Would prefer shorter meals. I will look at management practices upon return to the office.

Great really enjoyed it! I look forward to providing this information to growers and clients and through workshops. I will be using insect and disease info (general) for teaching others. I will be using GH info in workshops.

Dr. Cloyd and Dr. Gauthier were excellent presenters! I learned a great deal and feel more confident in identifying plant disease and knowing the difference between fungal and bacterial and viral diseases. I will use this information when working with growers and gardens.

Great job! We will be using this info in our school GH.

Would love another ISE at this location to take time for tour and more hands on with tour. I will check out resources and read up more on them, get periscope, apps and hopefully help more clients.

The workshop was personally interesting and challenging in every aspect. We should have more days.

Great ISE. Thank you for the color hand outs. I will use many things but most of all I am going to educate others that organic does not always mean better.

Some info was repeated, but it was good to have it re-affirmed. Excellent!

Classroom was cold. I will use info for training career development events.

I plan to use pesticide modes of action in making recommendations.

Practice better sanitation practices.

Green house insect and mite control will be most useful to me.

I will use techniques discussed in pest prevention to share and do research with my students.

Separate out the GH portion. I will use info regarding pesticides to directly influence which products I will buy this year.

Sanitation and pesticide information.

Insect and microbe pathogen identification inform is most helpful for me to my work with producers.

I think this was a good program b/c it gives you additional information and help you keep up with the changes with the ag industry.

Type of workshop should be offered 1-2 years with similar topics. Would like to know more about these topics.

Thank you!

This was great. Thank you for letting me take the class. I will now know how important it is to scout in the GH and monitor the plants often.

I will use the green house management and sanitation practices at my job.

For future workshops, if possible, more hands on activities with less PowerPoint presentations.

Project 15: Morphological Characterization of Injurious Eriophyid Mites on Black Walnut Trees

University of Missouri
Dr. Michele Warmund
Final Performance Report

Project Summary

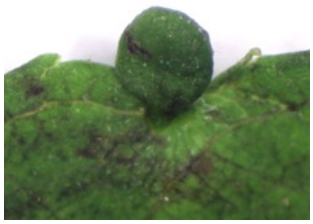
In the past five years, the incidence of black walnut petiole gall has increased with warmer ambient air temperatures and extended growing seasons in North America. Eriophyid mites inhabiting three types of galls on black walnut trees were examined using electron microscopy to compare the anatomy of larvae, nymphs, and adults of *Aceria* species. Larvae are ≤ 125 µm-long and lack microtubercles (body outgrowths) and genitalia, whereas nymphs of these species were distinguishable by these anatomical features. *Aceria caulis* nymphs within petiole galls develop earlier in the growing season (early May) than the other species and have shark-fin shaped microtubercles. Nymphs inhabiting the smooth leaf galls appear the latest (late May) and had both smooth and sharply pointed microtubercles. Nymphs within hairy leaf galls had sharply pointed microtubercles exclusively. Deutogynes (adult females) are also distinguished by their genitalia. *Aceria caulis* usually have two protrusions on the surface of the lower coverflap with 5 µm-long genital setae (hairs) and few inhabited galls by mid-August. Adult females from smooth leaf galls had a smooth coverflap with 5 µm-long genital setae from pointed tubercles. Deutogynes from hairy leaf galls also have a smooth coverflap but genital setae are ≥ 8 µm-long. This study provides new information on the comparative anatomy and seasonal occurrence of three unique gall mites and will enable producers to select control strategies when needed. This study did not build on a previously funded project with the SCBGP or SCBGP-FB.

Project Approach

In the past five years, the incidence of black walnut petiole gall has increased with warmer ambient air temperatures and extended growing seasons. These hairy, magenta-colored galls cause petiole distortions with cellular alterations, inhibit leaf development, and decrease nut production (Figure 1). This gall has been reported in New York, New Jersey, Maryland, West Virginia, Georgia, Pennsylvania, Ohio, Illinois, and Missouri. In 1867, Walsh reported that this gall was induced by a mite, *Eriophyes caulis*. H.H. Keifer reported that *E. caulis* most likely has two nymphal stages, followed by red-colored overwintering female deutogynes in 1940. Since the initial description of this mite, it has been reclassified as *Aceria caulis* and it is frequently confused with another poorly described mite, *Eriophyes brachytarsus*. However, with the enhanced resolution of scanning electron microscopy, anatomical features are distinguishable and species descriptions can be vastly improved as compared to those based on light microscopy.

A pouch gall containing unidentified eriophyid mites has recently been found on the underside of leaflets at multiple sites in the black walnut producing regions of North America. This mite

species induces numerous erinea-filled pouch galls on leaflets and causes premature defoliation (Figure 2). Also, another type of black walnut pouch gall was found on the upper side of leaflets in New Franklin, Missouri in June 2013 (Figure 3). Eriophyid mites are typically only 100 to 250 µm-long (0.10 to 0.25 mm) and require examination at high magnification using scanning electron microscopy to accurately describe anatomical features for species identification. Because gall-



inducing mites adversely affect black walnut tree growth and production, it is essential to correctly identify and describe these pests throughout the growing season. Therefore, the objectives of this project were to: 1) image, identify, and compare the anatomical characteristics of eriophyid mite species that induce pouch and petiole galls on black walnut trees; and 2) disseminate results of this study to black walnut producers via a presentation at a national meeting and published information on the internet.

Petiole and pouch galls were collected at three week intervals from black walnut trees growing at the University of Missouri (MU) Horticulture and Agroforestry Research Center, New Franklin, MO during the 2015 growing season. Eriophyid mites from each gall type were preserved in 2% gluteraldehyde/2% paraformaldehyde fixative. At each sampling date, images of at least 20 mites per gall type were acquired using the Quanta 600F Environmental Scanning Electron microscope (SEM) at the MU Electron Microscopy Core Research Facility at Columbia, MO. SEM images, as well as alcohol-preserved specimens were provided to Dr. James Amrine, Emeritus Professor, University of West Virginia, Morgantown, WV (taxonomic expert for mites) for verification of key identification characteristics. A presentation of study results was delivered to 125 producers, researchers, and extension specialists at the Northern Nut Growers Association annual meeting in La Crosse, Wisconsin on July 28, 2015. Research findings will also be published in the November 2015 issue of the MU Integrated Pest Management newsletter.

Goals and Outcomes Achieved

Prior to the project, Missouri producers had no knowledge of mites inhabiting black walnut trees. However, 95% of the Missouri Nut Growers can now recognize and distinguish the different mite species by their galls. All performance measures and targets were met with delivery of new knowledge about gall-inducing mites to 150 Missouri Nut Growers, 250 Northern Nut Growers, and over 1,000 subscribers to the Missouri environment and Garden subscribers. This study provides new information, including identifying species characteristics and images of mites at various life stages that induce galls on black walnut trees, to producers, extension personnel, and researchers. Prior to this study, only drawings of *Aceria caulis* were available in the literature. Images with scale bars are now available of all life stages of *Aceria caulis*, as well as two, newly-recognized gall-inducing mite species on black walnut trees. Male and female nymphs of each *Aceria* species are distinguishable by their microtubercles. *A. caulis* nymphs have shark-fin shaped microtubercles and genitalia. Females of this species usually have two protrusions on the surface of the lower coverflap and always have 5 µm-long genital setae. Nymphs from smooth leaflet galls vary in their microtuberculation, with some possessing smooth microtubercles while others are sharply pointed. Protogyne and deutogynes of this species have a smooth coverflap with 5 µm-long genital setae from pointed tubercles. Nymphs within hairy leaf galls have sharply pointed microtubercles only and females have a smooth coverflap but genital setae are ≥ 8 µm-long. *Aceria caulis* nymphs are visible in early May, while those from hairy leaflet galls appear later and those from smooth leaflet galls are the last to

develop in late May. By mid-August, most all *Aceria* caulis deutogynes had exited galls, while those from hairy leaflet galls persisted in galls longer, and by mid-October most deutogynes from smooth leaflet galls had left the galls. With this information, growers can make researched-based decisions on pest control measures.

Beneficiaries

The specialty crop groups and/or stakeholders that benefited immediately from this project are members of the Missouri Nut Growers (150) and the Northern Nut Growers Association (250). However, all black walnut producers and acarologists are ultimately beneficiaries of this work. Information posted on the Missouri Environment and Garden web site at http://ipm.missouri.edu/MEG/ is accessible globally. As a result of this project, these black walnut tree galls and their mite inhabitants can now be identified and nut producers can implement control strategies to limit their spread when they restrict yield.

Lessons Learned

All goals of this project were achieved. One lesson learned was that mites should be held at room temperature in fixative at least overnight to preserve and kill the mites.

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Additional Information

Article Posted: http://ipm.missouri.edu/MEG/

Three Gall-Inducing Mites Recently Described on Black Walnut Trees

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The incidence of galls, which are plant growths caused by another organism, often increases as trees mature. Three types of galls have been identified on black walnut trees at the University of Missouri Horticulture and Agroforestry Research Center near New Franklin, MO. The black walnut petiole gall, also known as the velvet gall, first appears in April in Missouri and has green densely-matted hairs called erinea. As the growing season progresses, erinea become magenta in color by June **(Figure 1)**, fade to dark red in July, and turn brown by September.

Figure 1. Black walnut petiole galls induced by Aceria caulis.

Figure 2. Black walnut hairy leaflet gall.

Figure 3. Black walnut smooth leaflet gall.

These galls cause twisting of the petioles, deform and inhibit leaflet growth, and limit nut production. Petiole galls are induced by feeding of *Aceria caulis*, which is an eriophyid mite. Within minutes after feeding, cellular changes occur within the plant tissue to sustain the developing mite colony. The gall also protects the eriophyid mites from some predators and provides shelter during the growing season. Overwintering female mites, known as deutogynes, exit the galls usually in early September before the other types of black walnut gall mites.

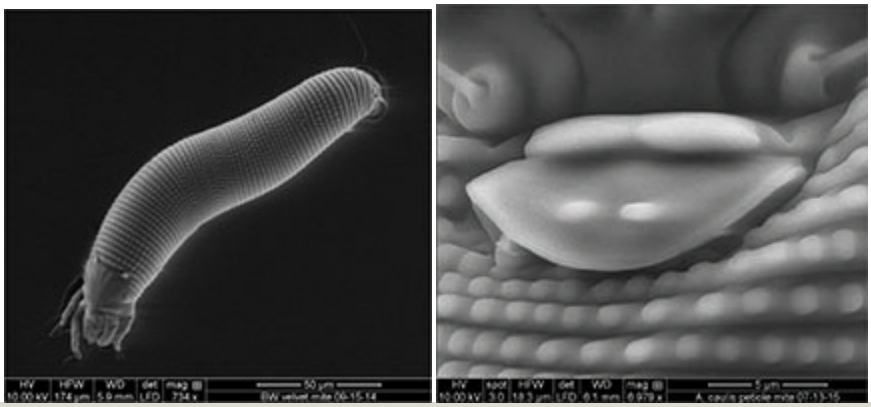

Figure 4. Overwintering female deutogyne of Aceria caulis and her genital coverflap.

A second type of gall, called the black walnut hairy leaflet gall is often found on trees **(Figure 2)**. This gall is visible by May on both the upper and underside of leaflets and green or magenta-tinged. When examined closely, the gall interior contains erinea-lined chambers containing another type of eriophyid mite. These galls appear later in the spring than the petiole galls and the deutogynes of this species exit the galls later in the fall.

The smooth leaflet gall is the latest gall to develop in May on black walnut trees **(Figure 3)**. It lacks hairs on the outer green surface of the gall, but inside is a mass of twisted and tightly-matted white erinea. However, in the summer when the mite colony is at its peak, the interior of the gall appears pink or red from many highly-colored mites feeding on the gall wall. These galls and the hairy leaflet galls are much smaller (2 to 3 mm) than petiole galls and may not be not as injurious to the black

walnut trees. Deutogynes of this mite species inhabit their galls until October, which is usually later than the other eriophyid species on black walnut.

Because these eriophyid mites are microscopic, scanning electron microscopy has been used recently to examine the anatomical features of larvae, male and female nymphs (protogynes) and the deutogynes **(Figure 4)**. Studies conducted at the University of Missouri revealed that each of the three black walnut galls is induced by three unique species with varying anatomical structures. While these anatomical features are subtle, they are distinguishing features for the species. These newly-described mite species that induce the leaflet galls will be named in the near future.

Project 16: Establishing Apiary at the Fisher Delta Research Center

University of Missouri, Fisher Delta Research Center
Dr. Moneen Jones
Final Performance Report

Project Summary

Missouri has more than 400 species of bees, and they are responsible for pollinating our cucumbers, pumpkins, fruit trees, berries, tomatoes, soybeans and corn. One estimate suggests that bees increase the annual value of U.S. crop production by $14 billion. Bees are necessary.

There were two main objectives of this research. The first was to establish an apiary at the Fisher Delta Research Center, so we can educate the growers, beekeepers, and general public on pollinator health. The second is to compare management protocols to determine which is the most productive and cost effective. This short grant period provided time to accomplish the first priority and plan for the next. This was an initial project funded by SCBGP.

We had a late start in mid-June with 4 nucleus hives with 3 queen replacements during the first month. The success of the program was evaluated by conducting weekly examinations of hive health by quantifying percent eggs, brood, pollen, and nectar (i.e. honey) per frame of each medium and deep box for each of four hives June – August 2015.

This first year we produced 89 pounds of honey, and we hope to expand our apiary to include 8 additional hives with 4 each of two additional strains.

Project Approach

Missouri has more than 400 species of bees, and they are responsible for pollinating our cucumbers, pumpkins, fruit trees, berries, tomatoes, soybeans and corn. One estimate suggests that bees increase the annual value of U.S. crop production by $14 billion. Bees are necessary

Honey bee colony growth and production are challenged by multiple factors including pathogens, weather, mites, beetles, and insecticide drift. Last month, the U.S. Department of Agriculture stated losses of managed honeybee colonies were 42.1%, an 8% increase from the previous year. Many commercial beekeepers believe that the use of neonicotinoids are harming the bees, and most recently the EPA is proposing a ban of spraying these chemicals when tree fruits are flowering.

The EPA currently receives its information on bee declines from commercial beekeepers. There are currently no University researchers for the state of Missouri conducting research on bee decline factors or determining the best management practices for beekeeping. Now is the time to determine quantifiable results as to the factors contributing to honey bee decline.

There were two main objectives of this research. The first was to establish an apiary at the Fisher Delta Research Center, so we could educate the growers, beekeepers, and the general public on pollinator health. The second was to compare management protocols to determine which is the most productive and cost effective.

The success of the program was evaluated by conducting weekly examinations of hive health by quantifying percent eggs, brood, pollen, and nectar (i.e. honey) per frame of each medium and deep box for each of four hives June – August 2015.

We had queen mortality in several of the hives early in the season. The queens in Hive Elizabeth were replaced 11 July and 22 July. The queen for Hive Beatrice was replaced on 16 July, and a queen was replaced for Hive Mary on 30 July. No replacements were made for Hive Charlotte.

Hive Components: Hives Charlotte and Mary had significantly higher egg production earlier in the season, whereas Hives Elizabeth and Charlotte had higher egg production mid-August (Table 1, Graph 1). When comparing brood production; Hive Mary was consistently the hive with the least amount of brood present (Table 2, Graph 2). There were no significant differences in pollen collected between the hives during the season (Table 3, Graph 3). Nectar (i.e. honey) production increased substantially in mid-September with Hives Beatrice and Charlotte having the greatest percentages of frames filled (Table 4, Graph 4). When all dates were combined for analyses of hive components, Hives Elizabeth and Charlotte produced significantly ($P > 0.05$) more eggs than Hives Beatrice or Mary (Table 5). For brood production, Hive Beatrice had significantly ($P> 0.05$) more brood on frames than the hives with Hive Mary producing the least amount of brood (8.23%, Table 6). There were no significant differences between productions of pollen (Table 7). Hive Mary had the least amount of nectar production (Table 8).

Pest and Disease: We did not have any mite pressure (sticky cards were placed in bottom boards late August), but we did have hive beetles early in the season. Four oil traps were placed into each hive early in the season to count their presence. In July, Hives Charlotte, Beatrice, Mary, and Elizabeth had 6, 3, 3, and 9 beetles, respectively. In August, Hives Charlotte, Beatrice, Mary, and Elizabeth had accumulated totals of 9, 25, 21, and 11 beetles, respectively.

Even though Hives Beatrice and Charlotte had the greatest number of frames filled with nectar, only Hive Charlotte was selected for honey harvest with enough surplus honey to not infringe upon over-wintering stores for the colony. Honey yield for this hive was 112 pounds, which is above average (50- 100 pounds) for a first-year honey harvest. Hives Beatrice and Mary had large numbers of hive beetles (25, 21) and pest stress could have hindered nectar production.

In October, each hive was supplemented with 2 gallons of sugar syrup with fumagilan B added. Usually the second year has more difficulty with insect pests and disease, so we will be diligent starting this spring with pest monitoring. We are bringing in 8 additional hives (4 each of 2 different strains) to compare management costs and outputs for our second year.

Goals and Outcomes Achieved

Goal 1. Establishment of an Apiary.
Target: Baseline Data for Honey Yield is recorded
Baseline Data: Because this grant established an apiary, there is no baseline data that previously existed.

The chief goal of establishing an apiary at the Fisher Delta Research Center was accomplished in mid-July. At that time, we had four working queens and good honey production. We were fortunate to employ a local beekeeper with 45 years of experience as our beekeeping consultant. If it was not for his help, we would not have had the opportunity to purchase replacement queens, nor would we have known that our colonies were in distress when queen cells appeared. The latter cells occur when a queen is not producing enough eggs, and the colony start to replace her. In other words, we learned a LOT in our first three months of beekeeping. With the acquisition of 8 additional hives next spring, we will start to establish an economic threshold for honey as a specialty crop. Inputs will include labor, costs of disease and pest control, and average market value of honey per ounce.

For the long term, we are working with the Missouri State Beekeepers Association (MSBA) to start a Certified Beekeeping Program for the state of Missouri. The requirements for certification include volunteer hours of hive maintenance by students, and hives located at the University of Missouri research centers will provide that opportunity. Currently, most second year beekeepers are dropping out of the hobby before they realize the cost and labor involved in rearing bees (personal communication, Valerie Duever, MSBA). Our second year of research will help to estimate these costs.

We would recommend that every new beekeeper seek a mentorship with a seasoned beekeeper.

Beneficiaries

There are two main beneficiaries of our research. First are the Missouri beekeepers, and the second are the bees. There are an estimated 1,000 hobby beekeepers in the state of Missouri. There are no actual records kept from any organization. Because we are currently using the apiary as a teaching location for beekeeping, an estimated 300 beekeepers per year could go through our beekeeping courses that we are establishing. With an increase in sustainable honey production, the populations of honey bees will increase in the state of Missouri. Establishment of best management practices (BMP) will help to stifle the resignation of second-year beekeepers.

Beginning beekeepers will benefit from this research with quantifiable costs and benefits of rearing bees. In addition, growers of row crops (i.e. soybean and corn) will have the opportunity of improved pollination and yield of their crops. Our hives are currently located at a research farm, and next season we hope to be able to associate our hive production with soybean and cotton yields in our small plot trials.

Lessons Learned

First lesson learned was to find an experienced beekeeper with the time necessary to help get started with beekeeping. We had two other beekeepers who said they would help us, and then they did not have the time.

Learn how to recognize when your project is in distress. We learned bee behavior to the point that we knew when to add additional frames or when our queens were not producing well enough. Each of the technicians who helped with the bees took precautions while working with them and learned how and when they could be approached for observation.

We had limited time to establish this project, so we purchased a variety of disease and pest control methods. Without past experience of beekeeping and knowledge of pest issues in our area, it was difficult to know which integrated pest management tools we needed. With that said, these still unanswered questions are the reasons why we need to continue this research for another year.

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Additional Information

Table 1. Differences in egg laying between hive colonies. Hive Mary was consistently lower in egg laying regardless of queen replacements.

	Differences in Percent Eggs Between Hives						
Hive	**7/13/15**	**7/22/15**	**7/30/15**	**8/7/15**	**8/14/15**	**8/25/15**	**9/14/15**
Beatrice	4.0±1.9 a	0.0±2.1b	4.0±1.8a	4.0±2.3a	0.0±2.8b	0.0±0.5a	0.0±1.5a
Charlotte	2.0±1.9a	6.5±2.1 a	3.5±1.8a	0.0±2.3a	5.5±2.8 ab	0.0±0.3 a	2.3±1.5 a
Mary	0.0±1.6 a	1.8±1.7 ab	0.3±1.5a	0.3±1.9a	2.7±2.8 b	0.0±0.9 a	0.5±1.5 a
Elizabeth	3.3±1.9 a	0.0±2.1 b	2.5±1.8a	4.0±2.3a	11.5±2.8 a	1.8±0.6 a	2.5±1.5 a

*Means followed by the same letter in the same column are not statistically different (LSD, $\alpha = 0.05$).
ANOVAS, 7/13/15: F = 1.06; d.f =3; P=0.372 (Hive); 7/22/15: F = 2.08; d.f =3; P=0.1082 (Hive); 7/30/15: F = 1.00; d.f.=3; P=0.395 (Hive); 8/7/15: F = 1.02; df =3; P=0.388 (Hive); 8/14/15: F = 3.76; d.f =3; P=0.014 (Hive); 8/25/15: F = 2.39; d.f =3; P=0.070 (Hive); 9/14/15: F = 0.74; d.f.=3; P=0.531 (Hive).

Table 2. Differences in brood production between hives. In this comparison, Mary and Charlotte had statistically different quantity of brood production.

	Differences in Percent Brood Between Hives									
Hive	6/22/15	6/30/15	7/6/15	7/13/15	7/22/15	7/30/15	8/7/15	8/14/15	8/25/15	9/14/15
Beatrice	15.0±7.6a	23.0±8.4ab	24.0±7.2a	14.3±5.1 a	14.5±5.1a	21.0±5.2a	20.8±5.9a	28.0±6.7a	22.8±4.5a	29.5±8.2a
Charlotte	25.5±7.6 a	28.5±8.4 a	21.0±7.2 a	16.8±5.1 a	14.5±5.1 a	18.0±5.2 ab	19.6±5.9 a	26.0±6.7 a	6.6±2.5 b	29.5±8.2 a
Mary	15.0±7.6 a	4.5±5.9 b	2.5±5.1 b	0.0±4.2 b	6.3±4.2 a	8.0±4.3 ab	7.7±4.8 a	13.8±6.7 a	14.0±7.9 ab	22.3±8.2 a
Elizabeth	15.0±7.6 a	22.0±8.4 ab	19.0±7.2 ab	13.8±5.1 a	10.0±5.1 a	5.0±5.2 b	12.9±5.9 a	12.8±6.7 a	23.1±5.6 a	25.3±8.2 a

*Means followed by the same letter in the same column are not statistically different (LSD, $\alpha = 0.05$).
ANOVAS, 6/22/15: F = 0.48; d.f =3; P=0.701 (Hive); 6/30/15: F = 2.40; d.f =3; P=0.080 (Hive); 7/6/15: F = 2.80; d.f =3; P=0.050 (Hive); 7/13/15: F = 2.90; d.f =3; P=0.040 (Hive); 7/22/15: F = 0.75; d.f =3; P=0.529 (Hive); 7/30/15: F = 1.31; d.f.=3; P=0.277 (Hive); 8/7/15: F = 1.31; df =3; P=0.277 (Hive); , 8/14/15: F = 1.44; d.f =3; P=0.238 (Hive); 8/25/15: F = 4.79; d.f =3; P=0.003 (Hive); 9/14/15: F = 0.19; d.f.=3; P=0.905 (Hive).

Table 3. Differences in pollen production between hives, with Hives Mary and Charlotte showing considerably lower amounts of pollen during late July.

	Differences in Percent Pollen Between Hives									
Hive	×6/22/15	6/30/15	7/6/15	7/13/15	7/22/15	7/30/15	8/7/15	8/14/15	8/25/15	9/14/15
Beatrice	0.5±0.6a	5.0±3.4a	11.0±4.9a	0.0±1.1a	1.5±1.0 a	2.0±1.9ab	0.0±0.8a	2.0±1.5a	2.8±4.4a	2.75±1.6a
Charlotte	0.0±0.6 a	1.0±3.4 a	6.0±4.9 a	0.0±1.1 a	0.0±1.0 a	1.5±1.9 ab	1.0±0.8 a	0.5±1.5 a	9.1±2.4a	0.5±1.6 a
Mary	1.0±0.6 a	7.5±2.4 a	9.8±3.4 a	1.7±0.9 a	1.0±0.8 a	1.3±1.5 b	0.7±0.7 a	3.5±1.5 a	7.0±7.6 a	0.75±1.6 a
Elizabeth	0.0±0.6 a	7.3±3.4 a	14.5±4.9 a	2.4±1.1 a	0.5±1.0 a	6.5±1.9 a	1.3±0.8 a	1.8±1.5 a	1.9±5.4 a	5.0±1.6 a

*Means followed by the same letter in the same column are not statistically different (LSD, $\alpha = 0.05$).
ANOVAS, 6/22/15: F = 0.73; d.f =3; P=0.539 (Hive); 6/30/15: F = 9,90; d.f =3; P=0.449 (Hive); 7/6/15: F = 0.53; d.f =3; P=0.666 (Hive); 7/13/15: F = 1.20; d.f =3; P=0.315 (Hive); 7/22/15: F = 0.40; d.f =3; P=0.752 (Hive); 7/30/15: F = 1.78; d.f.=3; P=0.157 (Hive); 8/7/15: F = 0.44; df =3; P=0.728 (Hive); , 8/14/15: F = 0,70; d.f =3; P=0.557 (Hive); 8/25/15: F = 0.65; d.f =3; P=0.468 (Hive); 9/14/15: F = 1.65; d.f.=3; P=0.185 (Hive).

Table 4. Differences in percent nectar (i.e. honey) between hives. Hives Mary and Elizabeth produced significantly less honey than Hive Beatrice. The latter hive was the single hive that produced enough honey to go to production.

	Differences in Percent Nectar Between Hives								
Hive	6/30/15	7/6/15	7/13/15	7/22/15	7/30/15	8/7/15	8/14/15	8/25/15	9/14/15
Beatrice	17.0±6.5a	18.0±6.3a	11.5±3.0a	19.5±4.6a	20.3±4.9bc	36.0±6.5a	43.0±6.9a	29.7±6.3a	59.5±8.7a
Charlotte	10.0± 6.5a	10.5±6.3 a	7.0±3.0 ab	11.0±4.6 a	36.3±4.9a	44.3±6.5a	17.5±6.9 b	29.3±3.5 a	54.8±8.7 ab
Mary	5.5±4.6 a	6.0±4.5 a	1.8±2.4 b	9.3±3.8 a	9.7±4.0 c	13.7±5.3b	31.3±6.9 ab	18.0±10.9 a	31.8±8.7 b
Elizabeth	12.0±6.5 a	6.5±6.3 a	8.8±3.0 ab	12.0±4.6 a	24.3±4.9 ab	31.3±6.5a	26.2±6.9 ab	33.0±7.7 a	31.3±8.7 b

*Means followed by the same letter in the same column are not statistically different (LSD, $\alpha = 0.05$).
ANOVAS, 6/22/15: F = 2.41; d.f =3; P=0.083 (Hive); 6/30/15: F = 0.73; d.f =3; P=0.540 (Hive); 7/6/15: F = 0.90; d.f =3; P=0.451 (Hive); 7/13/15: F = 2.39; d.f =3; P=0.075 (Hive); 7/22/15: F = 1.03; d.f =3; P=0.385 (Hive); 7/30/15: F = 6.11; d.f.=3; P=0.001 (Hive); 8/7/15: F = 5.09; df =3; P=0.003 (Hive); 8/14/15: F = 2.39; d.f =3; P=0.075 (Hive); 8/25/15: F = 1.32; d.f =3; P=0.271 (Hive); 9/14/15: F = 2.97; d.f.=3; P=0.037 (Hive).

Table 5. Comparison of egg laying between hives when dates are combined. ANOVA: F = 3.65, df=3, P=0.012

Hive	Mean± STDERR
Beatrice	1.33±-0.58b
Charlotte	1.58±-0.49ab
Elizabeth	3.00±0.60a
Mary	0.39±-0.52b

Table 6. Comparison of brood production between hives when dates are combined. ANOVA: F= 8.35; df=3, P< 0.001

Hive	Mean± STDERR
Beatrice	21.47±1.98a
Charlotte	15.58±1.68b
Elizabeth	15.37±2.04b
Mary	8.23±1.79c

Table 6. Comparison of pollen production between hives when dates are combined. ANOVA: F=0.84; df=3, P=0.471

Hive	Mean± STDERR
Beatrice	2.31±0.96a
Charlotte	4.20±0.81a
Elizabeth	3.55±0.99a
Mary	2.95±0.87a

Table 7. Comparison of nectar production between hives when dates are combined. ANOVA: F=11.21l df=3, P<0.0001

Hive	Mean±STDERR
Beatrice	27.98±2.23a
Charlotte	27.15±1.89a
Elizabeth	22.41±2.29a
Mary	13.14±2.02b

Figure 1. Differences in egg laying between the four hives. High production was observed in Hive Elizabeth late in the season.

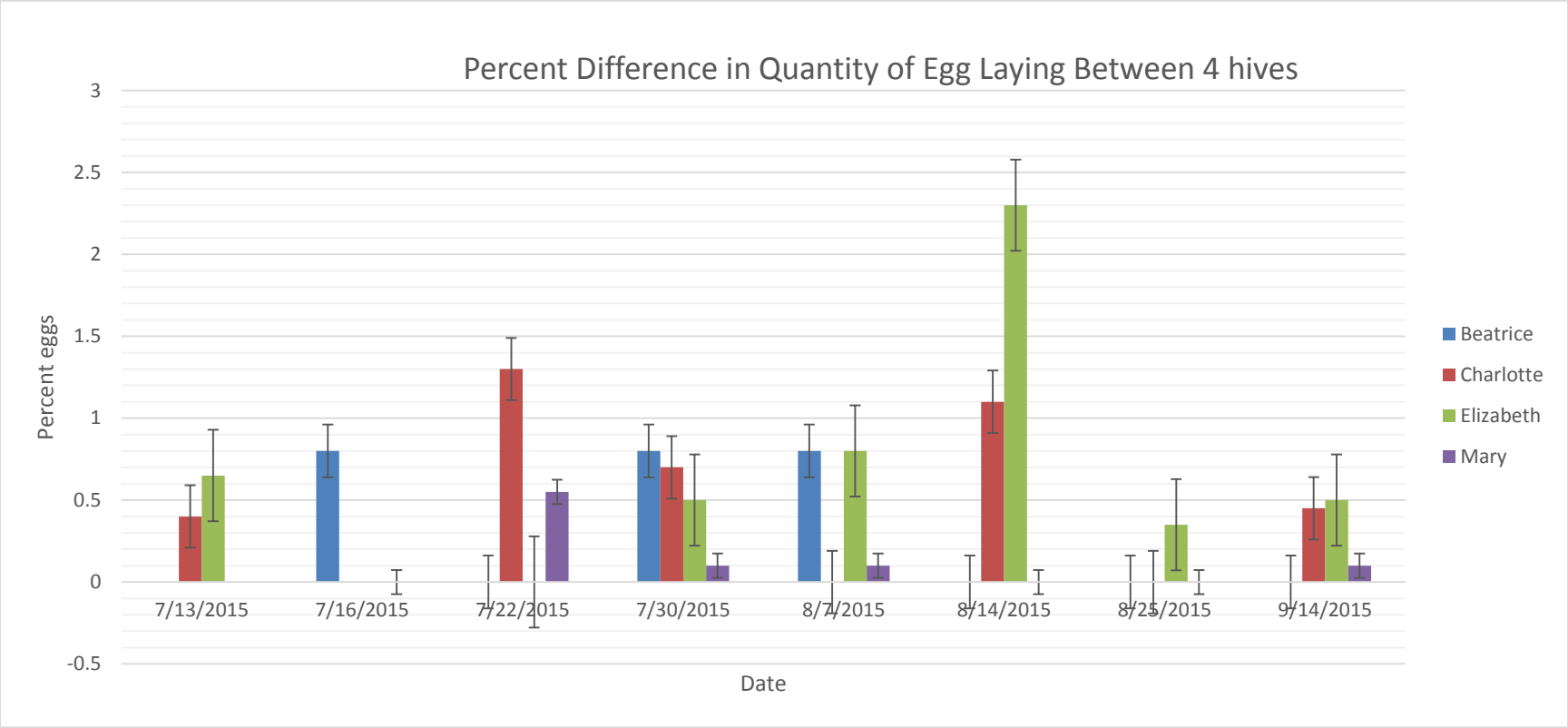

Figure 2. Differences in brood production between the four hives. Hives Beatrice and Charlotte were not significantly different in their brood production.

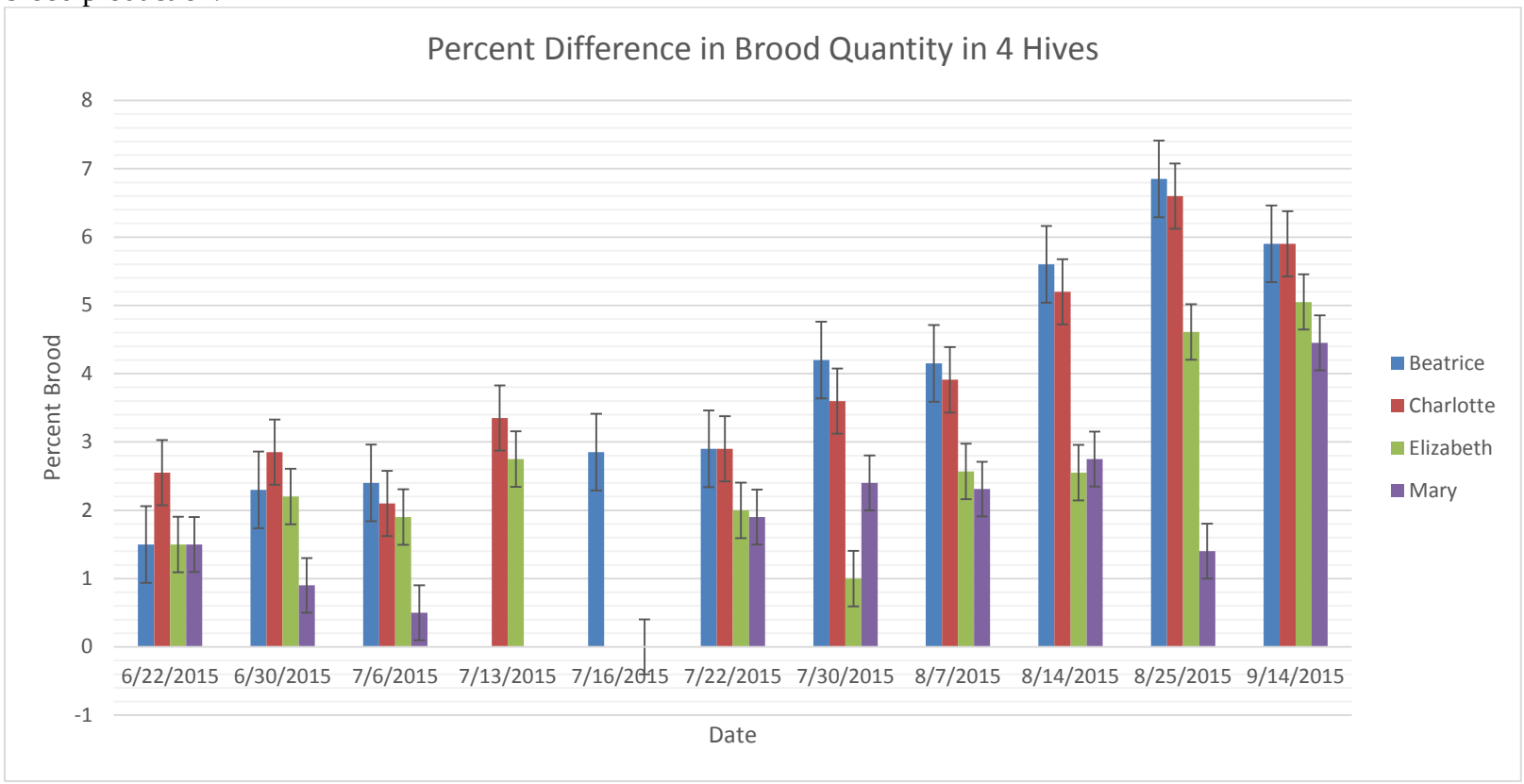

Figure 3. Differences in pollen production between the four hives. Hive Charlotte had the greatest amount of pollen collected.

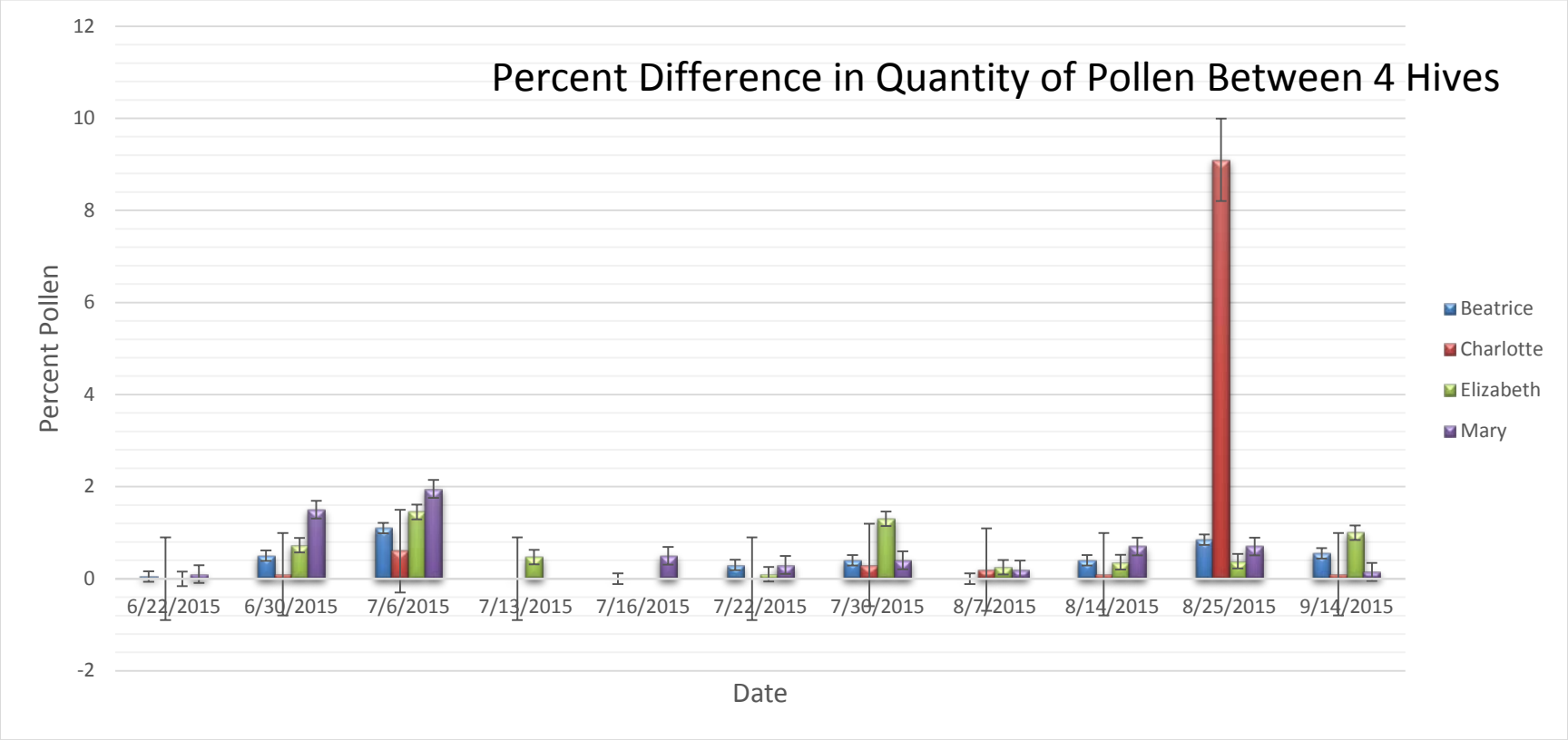

Figure 4. Differences in nectar production between the four hives. Charlotte had the highest quantity of nectar (i.e. honey).