FY 2010 SPECIALTY CROP BLOCK GRANT PROGRAM – FARM BILL
AMS Agreement: 12-25-B-1101

Virginia Department of Agriculture & Consumer Services
Final Report

Project Coordinator:
Melissa Ball
Division of Marketing
Phone: (804)786-5448
Email: Melissa.ball@vdacs.virginia.gov
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Performance of a Novel Solar Greenhouse Prototype

Naraine Persaud
330 Smyth - VA Tech
40-231-3817
npers@vt.edu

I. PROJECT SUMMARY

This final report[1] covers the period of performance November 1, 2010 through May 31, 2013. In spring of 2009, volunteers from the YMCA (ordinary citizens working together with scientists and engineers from private and public entities) constructed a novel prototype solar greenhouse[2] at 215 Maywood Street in Blacksburg, Virginia. Their intent was: (**a**) to demonstrate the feasibility of using soil thermal storage of solar energy to fully heat the greenhouse and produce vegetables or culinary and medicinal herbs during the winter, and (**b**) to use it as a test-bed for systematic applied engineering research to develop science-based, universally-applicable guidelines for design and operation of such solar heated greenhouses.

Some volunteers tackled this second purpose began collecting data on temperature and humidity inside and outside the greenhouse in the winter months (November, December, January , and February) of 2009-2010 and 2010-2011using low-cost semi-automated data acquisition instrumentation. But they needed a more comprehensive monitoring system to generate the dataset required to convince homeowners or entrepreneurs in the Commonwealth of Virginia and beyond to invest their time and money to adapt this solar greenhouse design at different scales of operation. This VDACS project was designed to provide this comprehensive dataset. VDACS obligated $27,064.00 to implement the project from 1 November 2010 through 31 May 2013 and $22,627.03 (close to 83 %) was spent (primarily on monitoring instrumentation, automated data acquisition, and data analyses) leaving a balance of $4,607.80. In what follows we provide the motivation and importance for the project for the Commonwealth of Virginia and beyond.

Greenhouses are important to the overall agricultural economy of Virginia. The state has over 17 million square feet of heated greenhouse area (under glass, polyethylene film, or polycarbonate protection) used primarily for nursery and floriculture. A rough estimate of the capital value of this investment is half a billion dollars. Estimated annual winter heating costs to maintain an inside temperature of 80 ^{o}F is about 10 to 20 million dollars (60 cents to $1.20 per square foot) and expected to increase with increasing cost of heating fuel and electricity. A solar greenhouse would use little or no commercial energy sources for heating. Anecdotal evidence suggests that to maintain an inside temperature of 80°F would cost about 7 cents per square foot operational costs for a properly designed solar greenhouse.

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[1] This report and archived data and results are at:
http://www.epiexamprep.cses.vt.edu/solar_greenhouse/index.html

[2] The following websites provide information (history, design, construction, climate controls etc.) on the prototype solar greenhouse and general information on solar greenhouses :
http://www.roperld.com/science/YMCAsolargreenhouse.htm
http://www.roperld.com/science/solargreenhouses.htm

Innovatively designed solar greenhouses can be used to produce vegetables (lettuces, cruciferous vegetables, tomatoes, beans, green peppers etc.) and specialty crops (culinary and medicinal herbs) in the winter when prices are higher. Increased availability would stimulate increased consumption leading to better health especially for lower income groups. This group spends 37 % less on vegetables than high income groups (USDA Consumer Expenditure Survey). The antioxidants and phytochemicals in diets high in vegetables and culinary herbs lower risk from many chronic diseases especially cancers, cardiovascular disease, obesity, and diabetes. Only 27% of Virginians are eating the nationally recommended daily 5 or more servings of fruits and vegetables that can reduce the risk of heart disease (the leading cause of death in Virginia) by 20 to 40%.

II. PROJECT APPROACH

We achieved the stated aims of the project. Activities and tasks performed and work accomplished during the grant period were as follows:

1. Collected a large amount of data using the instrumentation we purchased and installed starting November 2011 through March 2013 (in addition to data collected previously during the winter months of 2009-2010 and 2010-2011).

2. Analyzed the data collected, drew conclusions on the performance of the prototype solar greenhouse, and looked at possible modification to the existing design.

3. Published the data and results on a dedicated and publicly accessible website.

4. Contributed significantly to some of the broader aims of our (YMCA) community partners.

5. Prepared a write-up detailing algorithms to calculate solar irradiance on any arbitrarily oriented terrestrial surface. It was published online by CreateSpace, Charleston, South Carolina, USA and is available at http://www.amazon.com/Manual-Computing-Irradiance-Terrestrial-Surfaces/dp/1468142402/ref=sr_1_1?s=books&ie=UTF8&qid=1330272702&sr=1-1

6. Hosted a Virginia Tech's Scieneering Program (http://www.undergraduate.vt.edu/Scieneering/) Biological Systems Engineering student during the Fall 2011 semester. The program paid her to work 15 hours week to on project instrumentation and data collection. Mr. Matt Nottingham has volunteered his time to assist with the data collection.

7. Collaborated with the Virginia Cooperative Extension Services' to publicize the solar greenhouse on youtube at http://www.youtube.com/watch?v=P6QEFa5WXTE

We encountered no unexpected delays, impediments, and challenges in implementing the project. There were minor delays in the commercial ISP (Comcast) installing the internet gateway at the solar greenhouse and in the delivery of the components for some wireless sensor interfaces. The Derecho (July 2012) and Sandy windstorms (November 2012) interrupted the

internet connection with some data loss and required additional maintenance/replacement of the existing monitoring and automated data acquisition equipment.

The following significant results were realized:

A. **<u>Equipment purchase and installation</u>**: The following were purchased and installed

1. An industrial (point-of-sale) grade, accurate digital scale to weigh produce at the prototype solar greenhouse

2. An internet gateway at the prototype solar greenhouse to provide local and www network functionality

3. 3 ruggedized, industrial-grade, wireless, solar-powered weather stations from Davis Instruments[3] (see map pushpins and callouts on Figure 1). This supplier maintains free servers that permit registered users to monitor their stations in real time over the internet.

The 3 stations are as follows:

a. One Vantage Pro 2 Plus with add-on sensors logging fan-aspirated outside temperature and humidity, rain, wind speed and direction, solar radiation and inside temperature, humidity, soil moisture, and light levels at the prototype solar greenhouse (Hale-YMCA Community Gardens, 215 Maywood Street, Blacksburg VA 24060). These parameters are logged at 30-minute intervals (see the collage of pictures in Figure 2 showing some details of this installation).

To facilitate additional data collection and control of the instrumentation, we installed a PC that interfaces wirelessly with all the sensors at the prototype solar greenhouse. This PC can be accessed and controlled remotely (see the collage of pictures in Figure 2 showing some details of this installation).

b. One Vantage Pro 2 Plus logging fan-aspirated outside temperature and humidity, rain, wind speed and direction, solar radiation at the YMCA Center (1000 North Main Street, Blacksburg VA 24060). Data from this station is collected and archived by community volunteers.

c. One Vantage Vue logging outside temperature, humidity, rain, wind speed and direction at 870 Catawba Road, Blacksburg VA 24060. Data from this station is collected and archived by a community volunteer.

B. <u>Winter yields</u>: The yield data in Tables 1, 2, and 3 showed that growth-wise, the solar greenhouse met its designers' expectation during the 2010 -2011, 2011-2012, and 2012-2013 winter seasons. The growing season in the greenhouse was shorter in 2011-2012 and in 2012-2013 due to the early warmer, almost summer-like conditions starting in March. Figure 3 is a collage of pictures showing the interior of the solar greenhouse on March 6, 2012 is presented in

[3] Davis Instruments, Davis Instruments Corp. 3465 Diablo Ave., Hayward, California 94545. tel. 510 732-9229 http://www.davisnet.com/weather/index.asp

C. <u>Data Analyses</u> : In general, all meteorological data exhibit diurnal and annual cyclic behavior as a result of the direct influence of the earth's daily and annual rotations. Also, local episodic factors and influences are always superimposed on these embedded cycles in the observations. Therefore, the first question that we sought to answer in our analysis of the air temperature observations was: *how did the air temperature over time inside the greenhouse respond to these expected diurnal cycles in the air temperature observations outside the greenhouse?*

Plotting the outside air temperature observations over a 24-hour period would show the diurnal maximum and minimum but these would be masked by the superimposed episodic fluctuations. If there were no such fluctuations then the cycle would be a perfect single sine wave characterized by an amplitude (A) and phase (ϕ). This wave can be represented as $T(t) = A \sin(\omega t + \phi)$ where T(t) is the temperature at time t and ω is the angular period = $2\pi/P$ where P is the diurnal period in time units. For the outside temperature observations taken at the greenhouse P = 48 half hours starting at midnight and $\omega = 0.1309$ radian. For the inside temperature observations taken at the greenhouse P = 96 quarter hours starting at midnight and $\omega = 0.0654$ radian. The statistical variance of a number of discrete points on such a wave would be equal to $\frac{1}{2} A^2$. The variance of the actual observations would be always more than this because of the ever-present superimposed episodic fluctuations. If the actual variance is σ^2 then the extent of these superimposed episodic fluctuations can be quantified as the ratio of the variances of fundamental sine wave and the actual observations. Techniques (harmonic analysis) exist that allow extraction of A and ϕ for the sine wave embedded in a given set of actual T(t) observations.

Figure 4 shows the result of harmonic analysis of the temperature observations outside the solar greenhouse from midnight to midnight on 13 February 2011. The diurnal cycle accounts for 91% of the variance. Figure 5 shows the results for the temperature observations inside the solar greenhouse from midnight to midnight on 13 February 2011 The diurnal cycle accounts for 82 % of the variance in this case. For better comparison, Figure6 presents Figure 4 and 5 in a single graph.

Figures 4, 5, and 6 reveal that for 13 February 2011:

1. The average temperature was about 25 ^{o}F higher inside the solar greenhouse
2. The air in the solar greenhouse warmed quicker after sunrise reaching its average about 2½ hr before the outside temperature
3. The maximum temperature occurred earlier and the minimum temperature occurred later inside the greenhouse than outside (meaning the phase angles were different).

The next question was whether this behavior on the 13 February persisted throughout the two week period. These results are shown in Figures 7 and 8 and show that indeed this pattern persists. Figure 9 and 10 summarizes the results shown in Figures 7 and 8.

We wrote BASIC computer programs to format the data collected on average windspeed and direction plot monthly 16-point windroses. An example of one of these 24 plots is shown in

Figure 11. These data will be of interest to the wider community in relation to the feasibility of wind power generation and in modeling the dispersion of air pollutants.

III. GOALS AND OUTCOMES ACHIEVED

Activities that were completed to achieve the stated goals and outcomes for the project are: (a) equipment purchase, installation, and testing, (b) internet accessible, automated data acquisition and archiving, (c) data analyses and reporting. In addition, efforts were made to extend the project to benefit the larger community. Specifically, by (a) preparing and publishing a write-up detailing algorithms to calculate solar irradiance on any arbitrarily oriented terrestrial surface, (b) collecting yield data, (c) disseminating information via websites and social media (for example see you-tube video at http://www.youtube.com/watch?v=P6QEFa5WXTE), (d) providing support to expand the data collection beyond the solar greenhouse, (e) providing advice to individuals and groups on renewable energy applications greenhouse production (for example, assisting Mr. Ross Brown of Madison County Kentucky to build a 10'x 21' soil-heated solar greenhouse in his backyard using the subterranean heating and cooling system. Details are available at http://www.roperld.com/science/SGHBackyardSHCS.htm), (f) increase awareness and interest of homeowners or entrepreneurs in investing time and money in SHCS-based solar greenhouses for producing such specialty crops. The solar greenhouse is located next the Blacksburg Community Gardens and picnic area. We noted many gardeners showed great interest in our activities and asked questions about the prototype and its feasibility. Also, we encouraged many local schools that brought their students to visit the Community Gardens to also tour the prototype. We made available a 1-page handout on the prototype with a listing of the project websites' URLs for further information. In all, we estimate over 400 visitors toured the solar greenhouse between November 2010 through May 2013. We did not organize the proposed formal technical workshop. Instead we focused on the much less costly websites and U-tube videos as the preferred vehicles for disseminating the solar/soil heated greenhouse concept and data.

IV. BENEFICIARIES

The main beneficiaries of the project's accomplishments were: (a) local groups working towards sustainable development sustainable Blacksburg (see http://sustainableblacksburgva.org/) and (b) renewable energy engineers and scientists worldwide who now have access to a reliable dataset on soil-heated solar greenhouses.

Wide adoption of this technology for usable soil thermal storage of solar energy for greenhouse production at domestic and commercial scale would provide the following economic benefits: (a) less cost for winter vegetables in urban areas and increase in disposable income. USDA survey data show annual national per capita consumption of 170 lbs of fresh vegetables at a cost of $214.00 per person. If homegrown vegetables saved a modest 10% on this food basket item, it would be equivalent to $162 million savings in disposable income for the 7.6 million population in Virginia (2006 census), (b) less dependence on fresh vegetables imports. According to USDA data, the dollar value of fresh vegetable imports in the US increased from 2.6 billion in 2002 to 4.6 billion in 2007, and (c) development of markets for products and services related to

construction and maintenance of solar greenhouses leading to an expansion of agricultural support service and the overall economy of Virginia.

V. LESSONS LEARNED

A key finding of this project is that usable soil thermal storage of solar energy is feasible. More study is needed to determine ways to increase the thermal energy storage and how to optimize its recovery and use. For example, the solar energy was stored in a subterranean heat sink under the floor of the solar greenhouse. But would it be more cost-effective and operationally efficient to construct the sink next to and separate from the greenhouse structure?

VI. ADDITIONAL INFORMATION

The following provide information on publications, websites, and photographs:

1. All project data and results (including this report) are publicly accessible at:

2. The following publication "A manual on computing direct solar irradiance on plane terrestrial surfaces" is available at:
http://www.amazon.com/Manual-Computing-Irradiance-Terrestrial-surfaces/dp/1468142402/ref=sr_1_1?s=books&ie=UTF8&qid= 330272702&sr=1-1)

3. For further information contact: Naraine Persaud, CSES Dept., 330 Smyth, Virginia Tech, Blacksburg, Virginia 24061-0404. E-mail npers@vt.edu, Tel. 540 231 3817

Marketing Expansion Initiative Promoting VA Grown Christmas Trees

Jeff Miller
540-382-0943
treasurer@virginiachristmastrees.org

I. Project Summary

- The Virginia Christmas Tree Growers Association (VCTGA) is an organization with over 100 members. Member's farm size ranges from small choose and cut growers to large wholesale growers located in all 5 regions of Virginia. The VCTGA is seeking to take a stronger proactive approach toward improving the sale of Virginia Grown Christmas trees through increased brand awareness of Virginia Grown Christmas trees as a vital part of the "Virginia Grown" family of agricultural products. Greater identification within this very successful program will increase visibility for Virginia Christmas trees as a viable specialty crop produced and marketed throughout the state.
- The VCTGA is also seeking to better connect tree growers with a greater number of potential buyers by focusing primarily, but not exclusively, on civic, community, and non-profit organizations and groups. This goal helps the sale of Virginia Christmas trees by establishing greater visibility and marketing opportunities for its growers within the Commonwealth by creating viable marketing outlets and successful working relationships.
- Through this proposal we will offered assistance to ALL Virginia Christmas tree growers, regardless if they are members or not, because our main objective is to benefit the entire Christmas tree industry throughout the Commonwealth. Our goal was to further the marketing potential of Virginia Christmas trees and to increase civic relationships with many of Virginia's non-profit and civic organizations.
- Various ideas were generated within the VCTGA to meet these goals and objectives, but due to lack of funding have seen a shortfall in implementation. The VCTGA implemented project Marketing Expansion Initiative Promoting Virginia Grown Christmas Trees by having grower/buyer marketing expos throughout the state bringing growers and buyers face to face and also educate Christmas tree growers and buyers on how to utilize the "Virginia Grown" products available through the Virginia Department of Agriculture and Consumer Services.
- Virginia Christmas tree growers across the state have experienced a steady decline in sales during the past few years, and that has left quality trees standing in the fields after Christmas. Far too many of the Christmas trees purchased in Virginia are bought from sources outside of the state and marketing efforts must be implemented to change this trend and increase overall competitiveness in the market. If we can narrow the gap between our growers and Virginia buyers it would increases overall sales and ensure that Virginia consumers are getting the freshest tree possible from a local grower. Along with bringing the buyers to the table, we need to educate them on the use of renewable and sustainable resources. Public appreciation and brand awareness of locally grown and produced products are among the biggest benefits we have as tree growers.
- Christmas trees are an important part of Virginia's agriculture industry, contributing more than $35 million to the Commonwealth's total sales. The size of Christmas tree farms ranges

from less than an acre to as large as several hundred acres, with a few growers having a thousand or more acres. With figures like these, it is imperative that individual tree growers have the proper name brand recognition, and a connection to the "Virginia Grown" campaign, to increase product visibility and marketing recognition, as well as, an adequate structure available to help in promoting the sale of this seasonal specialty crop.

- As aforementioned, the association needs to refocus in order to gain more support from buyers within our home state. At the same time, we need to work harder to establish a greater competitive edge for our Christmas tree growers. A marketing expo in each region would allow local civic and non-profit groups to meet local Christmas tree growers and will help producers to better connect and understand customer needs and future trends in order to secure the financial stability of the Virginia Christmas tree growers.

II. Project Approach

2010 Fiscal Year

- In the spring, we did a survey of grower members and had about a 20% response from members who were interested in participating in marketing their Virginia grown tree.
- The VCTGA contracted with a design/marketing firm, Tom Kegley Communications, to create the marketing ideas and graphics from the VCTGA committee into a cohesive design of a new VCTGA logo, signage, banners, and two marketing brochures (copies attached).
- Over 2,500 of the "Experience a Real Tree" brochures have been distributed to 119 locations around the state with the VDACS 2011 Virginia Grown Christmas Tree Guide through the assistance of Leanne Dubois with VDACS marketing in Richmond.
- In late spring, we contacted civic organizations (potential buyers) via email, mail and personal calls to determine their current and future use of real Christmas trees as fund-raiser projects. They were all invited to the Virginia Christmas Tree Growers Association Annual Meeting on August 5, 2011 for a program on working with Virginia growers to promote and market real trees.
- At our Annual Meeting, Danny Neel and Charlie Conner (VCTGA director) made a presentation of the new VCTGA marketing materials and how buyers and sellers could use these materials to successfully sell more trees.
- VDACS Marketing staff, Danny Neel, has been extremely helpful in helping make contacts and guiding the VCTGA thorough the marketing promotion process.
- October 23, VCTGA Director, Greg Lemmer, participated in the Augusta Agritourism Festival in Waynesboro with the new VCTGA displays and distributed both brochures.
- The current website has been updated with information on the new marketing materials and a committee is working on a full revision of the website after this year's selling season. We are soliciting input from members and potential buyers on the layout and type of information that would be beneficial to have available on the website.
- Members have been sent order forms and lists of marketing materials/photos that are available for their individual marketing for this selling season.

2011 Fiscal Year

- In the fall of 2011, an additional 5,000+ brochures were distributed through VDACS Marketing.
- In early November, each VCTGA member received a 3'x6' banner promoting Virginia Grown Trees and the "Experience a Real Tree" marketing initiative. They also received a double sided 24" roadside sign and marketing brochures.
- This spring and summer, the VCTGA website was totally re-designed and much more consumer-friendly for Christmas tree buyers to locate a retail or choose-and-cut farm near them as well as buyers of large quantities of trees could locate wholesale growers by location, types of trees and quantities available. Members can now update their information and mini-webpage online themselves.
- All graphics and photographs used in the marketing effort are available online for VCTGA members to incorporate in their on marketing plans.
- This winter (January 2011), the VCTGA had a staffed exhibit promoting "Experience a Real Tree" at the Mid-Atlantic Nursery Trade Show (MANTS) in Baltimore for the 3-day event with over 10,000 attendees.
- In February, the VCTGA had an exhibit at the National Ruritan Annual Conference in Raleigh with several VCTGA members staffing the exhibit and also a speaker on their program about marketing Christmas trees as a civic fund-raiser.
- In September, the VCTGA joined the Virginia Green Industry Council with displays from the different green industry segments in the Meadows Pavilion at the State Fair of Virginia. The exhibit showcased a Canaan fir from Louisa County, Experience a Real Tree brochures with farm locator links and was staffed most of the time for 10 days.
- In November, Commissioner of Agriculture, Todd Haymore, cut the first ceremonial Virginia Grown Christmas Tree at Evergreen Tree Farm in Harrisonburg and received good publicity from the event.
- The VCTGA continues to sponsor the Virginia Farming Show on WVPT – Educational Television Corp and they have done several Christmas tree segments.
- Additional contacts with civic groups and other potential buyers continues to be an ongoing process.
- November 1-4, 2012, the VCTGA had a corner exhibit at The Christmas Show, at the Showplace, Mechanicsville Turnpike, Richmond, a regional consumer Christmas show with an attendance of several thousand consumers, again promoting "Experience a Real Virginia Grown Tree" with brochures, VDACS Christmas Tree Locator pamphlets, pencils and frig magnets and will be staffed by VCTGA members.
- A 1/3-page color ad was placed in the December 2012 issue of the "Virginia Living" magazine promoting "Experience a Real Tree" with a circulation of 35,000 copies and 25,000 online readers
- In November, 10,000 "Experience a Real Tree" brochure were distributed through VDACS to 5 visitors centers in Virginia to promote real trees and providing information to locate locally grown trees.

- In November and December, 5 weekly ads were placed in 76 daily and weekly Virginia newspapers with a combined circulation of 581,391 per week promotion "Experience a Real Tree with QR codes and links to www.VirginiaChristmasTrees.org for consumers to look up a cut-your-own farm or a retail location near their home.
- In January 2013, the VCTGA will again have a staffed exhibit promoting "Experience a Real Tree" at the Mid-Atlantic Nursery Trade Show (MANTS) in Baltimore for the 3-day event with over 10,000 attendees.
- We have had terrific support with ideas, participation and marketing efforts with the Virginia Department of Agriculture & Consumer Services marketing staff, especially from Danny Neel, David Robishaw, Leanne DuBois and Elaine Lidholm.

- At a Board of Directors meeting during the summer of 2010, we discussed at length our need to attract more customers. One of the primary concerns of our Association is the spectrum of our operations. At one extreme, we have the large wholesale operations selling tens of thousands of trees annually. At the other extreme are the small, family owned choose and cut farms that sell 500 or fewer trees each Christmas season. Our focus was to arrive at a strategy that would benefit the full spectrum of growers

- Present at the meeting was a marketing specialist who presented ideas, sample products and suggestions. While formal predictive modelling was not the necessarily the process we followed, it certainly became the practical outcome of the meeting. We examined, with the marketing specialist, what actions we could take, that were affordable, that would attract large retail customers to our large wholesale growers and what opportunities could we create to attract families to our smaller retail lots and choose and cut farms.

- Our conclusions formed the basis of the grant proposal. Specifically, add winter meetings to our association schedule and along with the annual summer meeting, to better educate our membership in terms of marketing, (actions taken and actions contemplated) and solicit their input. Secondly, broaden our internet presence and lastly, purchase print materials that advertise our product.

- The predictive model developed at the meeting is a living process that we continue to alter, revise and reorient as we examine the results, specifically the subjective reaction of the membership, to our initiatives.

- There are many types of civic organizations from Boy Scouts, Churches, to Ruritan Clubs who sell Christmas trees as a fundraising project for their organization. Our goal was to educate and encourage them to buy local, Virginia grown trees so they could offer a fresher product, place smaller initial orders and re-order local trees as the season progresses. We contacted state and region groups and invited them to our summer meeting to meet Virginia tree growers. We also setup an exhibit at the National Ruritan Convention. Locating contacts for civic organizations ended up being a more difficult endeavor than we'd originally anticipated. There aren't any "directories" and state Trgroups that did have contact with local groups were reluctant to provide local contact

info and would only send information out through their own network which wasn't as effective.

III. Goals and Outcomes Achieved

- It took a little longer than we'd planned to get the ball rolling due to some issues of hiring a knowledgeable part-time person to do some of our marketing research and find contacts with civic groups and other potential buyers. We were not able to get any civic group representatives to come to Blacksburg in early August, but have several that expressed serious interest. There were other conflicting events and vacations. Danny Neel has arranged a meeting in November with the executive director of the National Ruritans and they are interested in the VCTGA making a presentation on marketing trees at the national meeting in February 2012.
- It has been more difficult to contact and develop interest of civic groups to market and sell Virginia grown Christmas trees as a fund-raiser. As a result of this, we have targeted events with large attendance of consumers such as the Ruritan National Convention, the State Fair the Richmond Christmas Show, consumer trend magazines and newspapers.
- Many of our objectives and goals are long term, like the production of real trees, and we expect the program to continue to gain momentum as we progress to future seasons.
- We conducted a survey of members, with over a 20% response, after the Thanksgiving week and the majority had a significant increase in sales over the same period last year and expected this to continue through this selling season.
- Many members have participated in interviews on TV and radio stations as well as in newspapers and regional publications.
- Trees and wreaths were presented to the Governor's Mansion and to Senator Mark Warner's office by our state tree contest winner, Rodney Richardson, Mt. Rogers Christmas Tree Farm, Whitetop, Virginia along with our new marketing materials. This was strictly a promotional effort to place premium products in highly visible locations.
- Funding from this grant has enabled the VCTGA to establish a base marketing program which we will continue and expand on the progress and knowledge received to date.
- We first collected sales results after the 2012 holiday season, but have no comparative data. We are now in the process of gathering that information. We do have, through informal polling of the membership and assorted retail operations: impressions that the marketing initiative is of value as sales have increased; that many new customers cite learning of our individual businesses through internet research; and customers see our marketing, are reminded of the fresh trees they enjoyed in their youth, and as a result, shop for our trees.
- We will be able to statistically cite our measurable outcomes in the near future.

IV. Beneficiaries

- VCTGA members have benefited by being able to receive marketing materials (brochures, signs, banners and ideas) to help them promote their business and to reach out to new markets (civic groups and individual consumers).
- Consumers have benefited by having positive information and tips on selecting and maintaining a real Christmas tree to have a memorable Christmas season.

- Through our revised website, consumers and large buyers and non-profit organizations have access to a database of sources of fresh real trees in their area.
- Virginia Department of Agriculture & Consumer Services now has additional materials to help promote the marketing of Virginia Grown Christmas Trees.
- We know there are 110 members of the Virginia Christmas Tree Growers Association. We do not know how many other Christmas tree farms exist in the Commonwealth, nor are we aware of the total number of retail lots. We take comfort in knowing that every Christmas tree operation, particularly those retail lots in church parking lots, volunteer fire department stations, school athletic facilities, farmers markets, etc. and by extension, all growers, enjoyed increased visibility from the marketing initiatives taken by the VCTGA and made possible by the USDA SCBGP.

V. Lessons Learned

According to our records, the benchmark was to be established in 2010. Our initial proposal was submitted in the early spring of 2010 and in a letter dated October 12, 2010, we learned we were awarded a FY 2010 SCBGP grant. As you might expect, Oct – Dec is a very busy time for Christmas tree farmers and there was little opportunity to gather a workgroup and began planning specific actions and developing plans to capture measurable outcomes.

It was not until we began drafting the FY 2012 proposal that we took a much harder look at measuring outcomes. We did develop a survey and did capture benchmark statistics. The first lesson learned is for the Association to recognize that our Association is made up of volunteers and substantially more time needs to be reserved for our members to prepare a response (answer the survey). We should have realized that our membership is a cross-section of society, that the larger (professional?) growers keep more thorough business records and are in a better position to: a) help develop a survey, and b) respond to a survey. Conversely, many of the smaller growers only keep minimal records, may not have experience in business or grow Christmas trees as a second job on a part-time basis.

The second lesson learned is to be more attentive to the guidelines and instructions of the SCBGP. Several fine examples exist in the guidelines but we opted to focus more generalized outcomes instead developing specific measures. We believe that we have already benefitted from the lessons learned as in preparing the 2012 and 2013 proposals. We included plans to conduct survey s and scheduled a time in the typical grower's schedule that is not quite so intense (Jan/Feb) to ask for the data. We distributed the survey forms just after the holidays via newsletter, email, and social media. And lastly, we timed the survey so the responses could be collated and presented at our winter meeting.

We believe our association has benefitted as a direct result of our participation in the SCBGP. We look forward to documenting that premise with the pending results of our 2013 survey and sincerely appreciate your patience and assistance as we negotiate the learning curve.

VI. Additional Information

Jeff Miller, Virginia Christmas Tree Growers Association
540-382-0943, treasurer@virginiachristmastrees.org

Increasing the Competitiveness of Virginia Specialty Crop and Disadvantaged Farmers through a Statewide Situational Assessment of the Virginia Farm-to-School Program

Matthew Benson
540-522-0762
mcbenson@vt.edu

I. Project Summary

The Virginia Farm to School Program is an effort to increase the amount of fresh and nutritious Virginia Grown products offered in schools and to promote opportunities for schools and local farmers to work together (Virginia Department of Agriculture and Consumer Services, 2012). The Virginia Farm to School Program officially began through legislation passed in 2007, Senate Joint Resolution 347 (2007), which requested for the Virginia Secretary of Agriculture and Forestry and the Secretary of Education to establish a Farm to School Task Force charged with developing a plan for implementing Farm to School in Virginia. The task force met and identified a number of challenges to Farm to School in Virginia, including product availability, distribution, product costs, food safety, labor, and education. To address these challenges, the task force developed four recommendations which were: 1) to strengthen the partnership between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Education, 2) design a VDACS Farm to School website to include sections for farmers, distributors, and educational institutions, 3) identify funding sources for certification assistance in Good Agricultural Practices, and 4) conduct a pilot study (Virginia Farm to School Task Force Report). Since 2009, Virginia has held a Farm to School Week every year. In 2010, the Virginia General Assembly passed House Joint Resolution 95 (2010), which officially declared the second week of November as Virginia Farm to School Week. **In October of 2010, the Department of Agricultural and Extension Education at Virginia Tech was awarded a Virginia Specialty Crop Grant to complete a statewide mixed methods evaluation of the Virginia Farm to School Program.**

This project followed an interdisciplinary, collaborative approach to meet project aims. The overall objectives were to help increase the purchasing of Virginia fruits and vegetables for: 1) all Virginia school divisions for all school lunches, 2) enrolled USDA Fresh Fruit & Vegetable Program schools and 3) the 2011 and 2012 Virginia Farm to School Weeks. The project activities included pre-survey forums, a statewide survey of school nutrition directors, focus group sessions, key informant interviews, educational workshops, a mentorship network, and a final project report in the form of a "Farm to School Resource Guide." The project was originally funded from 10/01/10 to 09/30/12. The project was extended for an additional year through 9/30/13. All project activities have been successfully completed and each aim has been developmentally addressed through the completion of project deliverables.

II. Project Approach

A. Activities and Tasks Performed:

I. Project directors **collaborated with project steering committee** including representatives from the Virginia Department of Education, Virginia Department of Agriculture and Consumer Services, Virginia Cooperative Extension, Virginia Tech, Virginia Farm Bureau, Local Food Hub, and Fall Line Farms to complete several project

deliverables. The project directors met with the steering committee to update collaborators about activities performed and to gain feedback about next steps for action. Project directors met with the steering committee twice including in January 2012 and October 2012 in Charlottesville, Virginia. Project directors also completed several phone calls from 2010-2013 with Virginia Farm to School Program coordinators from the Virginia Department of Education and Virginia Department of Agriculture and Consumer Services to gain additional input and direction.

II. Project directors **completed a statewide survey of Virginia school nutrition directors** (n=138) to measure their attitudes, knowledge, and behaviors related to strengthening the Virginia Farm to School Program as an institutional market for Virginia specialty crop and disadvantaged farmers. Data from this survey were analyzed and summarized in a survey report. Information was then publically disseminated at several educational events which took place both inside and outside of Virginia. A report summarizing this research is attached.

III. Project directors **completed a series of focus groups and key informant interviews** with Virginia school nutrition directors, specialty crop and disadvantaged farmers, and local and regional food distributors to gain information about their experiences with the Virginia Farm to School Program. Project directors completed two focus groups with school nutrition directors, cafeteria managers, and program assistants in Virginia Beach, Virginia. Project directors completed two individual interviews with local and regional food distributors in central and eastern Virginia. Project directors completed three individual interviews in northwest (1) and eastern (2) Virginia, and one group interview with specialty crop and disadvantaged farmers in Virginia Beach, Virginia. The farmer interviews took place with a diverse group of producers/growers from across Virginia. Data from these focus groups and interviews was analyzed and summarized for review by steering committee. Information was then publically disseminated at several educational events and professional meetings, which took place both inside and outside of Virginia. A report summarizing this research is attached.

IV. Project directors **completed several presentations and workshops** (oral and poster) about this research at Virginia-based conferences and national conferences. Below is a list of the educational events project directors presented and disseminated research results:

   a. Virginia Tech Department of Human Nutrition, Foods, and Exercise Seminar, February 2012, Blacksburg, VA (approximately 40 individuals attended presentation).
   b. 2012 Virginia Local Foods Network Conference, February 2012, Richmond, VA (approximately 75 individuals attended presentation).
   c. 2012 Agriculture, Agriculture and Human Values National Conference, February 2012, New York City, NY (approximately 35 individuals attended session, including National Farm-to-School Network leadership).
   d. 6th National Farm to Cafeteria Conference, August 2012, Burlington, VT (approximately 800 individuals attended conference poster session).

e. 2012 Virginia Educational Research Association Conference, September 2012, Charlottesville, VA (approximately 20 individuals attended session).
f. 2013 Galaxy Extension Conference, September 2013, Pittsburg, PA (approximately 30 individuals attended session).

V. Based on assessment research results and continued steering committee input, project directors have completed the culminating derivable of this project: **Virginia Farm to School Resource Guidebook** for Virginia Farm to School Program stakeholders to help connect more local and regional farm products to school cafeterias. Project directors met with the steering committee in October 2012 to receive input about the current draft to then finalize the composition of this guidebook. The resource guidebook was then further developed in spring and summer 2013 with review by the project steering committee and several other external reviewers before it was finalized and disseminated. Attached is the final Virginia Farm to School Resource Guidebook that has been published through Virginia Cooperative Extension. This resource guide has been printed and disseminated as a final project deliverable to project stakeholders.

VI. Project directors have **completed trainings** using this research and resource guide to several Virginia-based conference groups and professional development sessions. Below is a list of the educational events project directors provided workshop trainings for:

a. 2013 Virginia Cooperative Extension Annual In-service Training, January 2013, Blacksburg, VA.
b. 2013 Virginia School Nutrition Association Annual Meeting, March 2013, Virginia Beach, VA.
c. 2013 Virginia Weight of the State Annual Conference, April 2013, Richmond, VA.
d. A Farm-to-School Track is being offered at the 2013 Virginia Farm to Table Conference, to be held at the Blue Ridge Community College in Weyers Cave, VA. Project directors are scheduled to provide leadership to plenary sessions, present the resource guide during a full session and disseminate hard copy resource guide materials during this two day conference event (December 4th and 5th).

VII. Project directors are **completed table displays** disseminating information about this research project and results of the evaluation at several Virginia-based conferences. Below is a list of the educational conferences project directors will have table displays (to date):

a. 2012 Virginia Farm to Table Conference, December 2012, Weyers Cave, VA.
b. 2013 Local Foods Network Conference, February 2013, Richmond, VA.

Targeted Approach of Specialty Crops: While some farm-to-school procurement activities can involve products other than specialty crops, the project directors worked with specialty crop producers, distributors of specialty crops in Virginia, and Virginia school nutrition directors whose procurement practices included Virginia specialty crops for the final deliverable of developing the Virginia farm-to-school resource guide. This targeted approach was ensured through the mixed-methods assessment protocol used to evaluate the Virginia Farm-to-School Program where specialty crops (e.g., fresh fruits and vegetables) and specialty crop procurement challenges and opportunities (e.g., procurement of locally produced lettuce into schools) were

identified by producers, distributors, and school nutrition directors. This information went directly into the development of the farm-to-school resource guidebook (pages 3-4)

III. Goals and Outcomes Achieved

A. Summary of project deliverables completed based on activities proposed:

Project directors have completed all target goals and activities stated in proposal:

1. Project steering committee assembled: **Complete** ✓
2. Statewide survey of Virginia school nutrition directors: **Complete** ✓
3. Focus groups with school nutrition directors: **Complete** ✓
4. Key informant interviews with food distributors and specialty crop and disadvantaged farmers: **Complete** ✓
5. Project research reports and Farm to School Resource Guidebook: **Complete** ✓
6. Educational workshops: **Complete** ✓
7. Mentorship network of farm to school professionals: **Complete (and on-going)**✓
8. Manuscripts for research publication: **In-draft**✓

*B. Outcomes: As a direct result of this research project, new knowledge and insight was gained about the Virginia Farm to School Program, partnerships involved, and the ability to support farmer participation through school food procurement. The following key points are summarized though project research activities: state-wide survey of V*irginia school nutrition directors and interviews and focus group sessions with Virginia school nutrition directors, specialty crop farmers, and food distributors participating in the Virginia Farm to School Program.

1. Virginia school nutrition directors attitudes, knowledge, and behaviors towards the Virginia Farm to School Program:
   a. 45 percent of respondents reported developing purchasing relationships with local farmers.
   b. 40 percent of respondents reported inviting a farmer to a school to support education about local food and agriculture.
   c. 36 percent of respondents reported planting a school garden.
   d. 32 percent of respondents reported working with teachers to include classroom-based curriculum featuring local foods and agriculture.
   e. Virginia School nutrition directors most strongly agreed with the potential benefit of Farm to School as it increases support of Virginia farms and/or businesses and that schools support their local economy and local community by purchasing local foods.
   f. Virginia School nutrition directors stated that the biggest potential problems of Farm to School were the seasonal availability of local foods and the inadequate supply of local foods.

g. To increase the purchasing of local foods as part of Farm to School programs, Virginia school nutrition directors stated that they wished that more local food was available from distribution companies who they normally purchase from.
h. Virginia School nutrition directors also stated that if there was one place for ordering local foods from multiple farmers their likelihood for greater participation in Farm to School would increase.

2. Virginia school nutrition director, specialty crop farmer, and food distributor experiences and involvement with the Virginia Farm to School (F2S) Program:

a. Key themes from Virginia specialty crop farmers participating in F2S:
   - Accessibility of Participation: Distribution to schools is and continues to be challenging.
   - Price Point Negotiation: Current funding structure for the school lunch program should to be examined.

b. Emerging themes from food distributors participating in F2S:
   - Local Actors Key: School nutrition directors are instrumental to the initiation of local area farm to school programs..
   - Marketing Niche: Schools provide farmers a new market opportunity for products that could not be sold to other outlets.

c. Emerging themes from Virginia school nutrition directors participating in F2S:
   - F2S Week Crucial: An earlier date for Virginia Farm to School Week would be preferred because of the seasonality and availability of local food.

GOAL 1: Increased purchasing of Virginia fruits and vegetables by all Virginia school divisions for all school lunches. **(REACHED GOAL)**

Based on the fall-winter 2011 survey of Virginia school nutrition directors, the number of respondents reported purchasing fruits and vegetables directly from Virginia farms or buying Virginia farm-grown fruits and vegetables through distributors through the school years of:

- 2009-2010: 60 % (n=27); **30%** of reporting Virginia school divisions (21% total)
- 2010-2011: 64.8% (n=35); **38%** of reporting Virginia school divisions; (26 % total)

→ Exceeded benchmark of 15% of Virginia schools divisions reporting purchasing Virginia farm-grown fruits and vegetables directly or through a distributor of specialty crops.

→ A second survey of Virginia school nutrition directors would be required to determine growth of Virginia school divisions purchasing Virginia fruits and vegetables directly or through a distributor between fall 2012-October 2013.

GOAL 2: Increased purchasing of Virginia fruits and vegetables by enrolled USDA Fresh Fruit & Vegetable Program (FFVP) schools for the FFVP. **(REACHED GOAL)**

Based on the fall-winter 2011 survey of Virginia school nutrition directors, the number of respondents reported participation in the USDA Fresh Fruit & Vegetable Program: 41.5% (n=34); 37% of reporting Virginia school divisions (26% total)

→ Exceeded benchmark of 15% of enrolled Virginia FFVP school divisions reporting purchasing Virginia farm-grown fruits and vegetables directly or through a distributor for the FFVP.

→ A second survey of Virginia school nutrition directors would be required to determine the number of Virginia school divisions participating in the FFVP purchasing Virginia fruits and vegetables directly or through a distributor for the FFVP between fall 2012-October 2013.

GOAL 3: Increased purchasing of Virginia fruits and vegetables for the 2011 and 2012 Virginia Farm-to-School Weeks by all Virginia school divisions (note: evaluated for 2009-2011 based on time of survey implementation). **(REACHED GOAL for 2009-2011)**

Based on the fall-winter 2011 survey of Virginia school nutrition directors, the number of respondents reported purchasing fruits and vegetables directly from Virginia farms or buying Virginia farm-grown fruits and vegetables through distributors through the school years of

- Participation in 2009-2010 Virginia Farm to School Week= 56.1% (n= 46); **51%** of reporting Virginia school divisions (36% total)
- Participation in 2010-2011 Virginia Farm to School Week = 68.3% (n=56); **62%** of reporting Virginia school divisions (43% total)
- Additionally, the majority of respondents stated they continue purchasing Virginia fruits and vegetables throughout the 2010-2011 school year (64.8%)(n=35)

→ Exceeded benchmark of 23% of Virginia schools divisions reporting purchasing Virginia farm-grown fruits and vegetables for 2009-2011.

→ A second survey of Virginia school nutrition directors would be required to determine the number of Virginia school divisions purchasing Virginia fruits and vegetables during the 2012 Virginia Farm-to-School Week.

IV. Beneficiaries

This research included three specific stakeholder groups: *School Nutrition Directors, Specialty Crop Farmers, and Virginia Cooperative Extension Professionals and other Agricultural Educators*. These groups directly benefited by participating in research activities (e.g., survey, focus groups, and interview), numerous educational trainings and presentations, and completion and dissemination of Virginia Farm to School Resource Guide.

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application. The number of stakeholders directly affected by the implementation of the project per group therefore includes approximately the following:

Virginia School Nutrition Directors: n=138
Specialty Crop Farmers in Virginia: n=80
Coop. Extension Professionals and other Agricultural Educators (VA and nationally): n= 275

Virginia Farm to School Program steering committee whose guidance and editorial input were instrumental in the successful completion of this research and final resource guide:

- Chris Cook, Virginia Foundation for Agricultural Innovation and Rural Sustainability
- Catherine Digilio Grimes, Virginia Department of Education
- Leanne DuBois, Virginia Department of Agriculture and Consumer Services
- Andrea Early, Harrisonburg City Public Schools
- Trista Grigsby, Rappahannock County Public Schools
- Molly Harris, Lulu's Local Food
- Lisa Landrum, Goochland County Public Schools
- Morgan Maloney, Arcadia Center for Sustainable Food and Agriculture
- Emily Manley, Local Food Hub
- Tammy Maxey, Virginia Farm Bureau, Virginia Agriculture in the Classroom
- Ron Saacke, Virginia Farm Bureau

This study did not include an economic analysis of the Virginia Farm to School Program. (pages 6-8)

V. Lessons Learned

A. *Positive results and conclusions for the project:*

The most significantly positive result of the project was the development and completion of the *Virginia Farm to School Resource Guide,* which was designed to help cultivate connections between the many diverse stakeholders that support the Virginia Farm to School Program. This guide intends to help facilitate locally and regionally-grown Virginia foods to school cafeterias and school-based meal programs. It contains research-based information, resources, and advice that can help start or expand a Farm to School initiative. For example, there are a number of strategies and best practices that can be implemented by Virginia school nutrition directors, farmers, food hubs and food distributors, and agricultural educators. These activities are based on research that was completed as part of the Virginia Farm to School survey and a series of interviews and focus groups with Farm to School stakeholders, all of which were a research activity funded by this project.

B. *Problems and/or delays related to the project:*

The term of the grant was originally a two-year timeframe. As stated in the first year report, one of the project directors left their full-time employment with Virginia Cooperative Extension and returned to graduate school at Virginia Tech. This change in personnel changed the timeline of the grant. The timeline was also impacted during year one during the survey dissemination stage, which was reported in year one. These timeline changes, along

with unexpected cost savings, prompted a reallocation of grant funds to best impact the plan of work for the remainder of the grant project. Changes to project timeline and changes to the budget were approved by the Virginia Department of Agriculture and Consumer Services and the Office of Sponsored Programs at Virginia Tech in April / May 2012. A 12-month no-cost extension was also completed and formalized through a Memo of Understanding (MOU) dated on October 11th 2012. The term of original MOU is hereby extended: October 1, 2010-September 30, 2013.
* No income was gained as a result of project activity

VI. Additional Information (Include contact information)

A. Major Deliverables (as attachments):

1. Appendix A: A **summary report** of the survey of Virginia school nutrition directors.
2. Appendix B: A **summary report** of the focus groups and interviews with Virginia school nutrition directors, specialty crop farmers, and food distributors.
3. Appendix C: The **final** Virginia Farm to School Resource Guidebook.

B. Contact Information:

Kim Niewolny, PhD (Project Director)
Assistant Professor and Extension Specialist
282 Litton Reaves Hall (0343)
Department of Agricultural & Extension Education
Virginia Tech
Email: niewolny@vt.edu
Phone: (540) 231-5784

Matthew Benson, PhD (Co-Project Director)
USDA Farm to School Program, United States Department of Agriculture
Email: matthew.benson@fns.usda.gov
Phone: (202) 720-6740

Specialty Crops Cooling and Packing
Kevin Semones
276-730-3128
farmersmarket@carrollcountyva.org

I. Project Summary

The purpose of this grant was to develop a portion of a new container inventory for the growers in our region. In the past it has been very difficult for small growers in the region to obtain new containers conveniently at a reasonable price. Most small producers do not need full tractor-trailer loads of containers nor can they afford them. Thus they are forced to pay high prices for smaller quantities and travel considerable distances to attain. This specialty crop grant was a first step in attempting to correct this problem.

The market has been working on various cooling, marketing, and production projects for specialty crops in the region for many years. This grant is the start of trying to put the pieces of the puzzle together. If our small producers are to remain in the game, the must have a new reasonably priced container to market their products in.

II. Project Approach

We assessed the needs of new containers for our region. While there is a long list of such needs, we determined that we would start with 1/2 bushel waxed, 1 1/9 bushel waxed, 1 7/8 bushel waxed, 25 pound tomato boxes, and 36" bins. In terms of numbers the market has purchased 6905 1 1/9 bushel, 6138 1 7/8 bushel, 2555 ½ bushel, 7200 25# tomato boxes, and 200 36" bins. There was also a small portion of waxed broccoli boxes.

While there is still a significant need to increase this inventory, both in terms of numbers and types, this appears to have been an excellent start. To date, 18 growers from six counties in the region have benefited from this program and this will only continue to grow as more growers become aware of this service. We will continue to talk about the inventory at grower meetings this winter as well as during one or more production meetings. Based on prices that growers have told us they were paying, we would estimate that the $3,000 investment will return between $6,000 – $17,000 annually. This return goes directly to the growers through reduced cost. The unique thing about this project is that as long as it is managed properly this return can be multiplied each year for decades to come. Thus making this an excellent project in terms of savings to Virginia's producers.

The groups involved in this project include VDACS, Carroll County, and the SW VA Farmers Market. VDACS' role has been that of management of the grant. Carroll County serves as the Market operator. The Market staff has examined needs, took bids, purchased containers, unloaded, stored and reloaded containers.

III. Goals and Outcomes Achieved

The main goal/outcome of this project has always been to provide growers with a convenient/reasonably priced source of containers. Growers in the past have had to pay excessively high prices and/or shipping fees to attain smaller quantities (less than trailer load lots) of containers. Containers for some vegetables often cost 20% to 25% of the gross price of the product when sold. Containers are a necessary evil in the produce business. Thus anything we can do to lower the cost of this required input is money going back into the grower's pocket. Generally speaking, we are looking at 10 cents to $2.50 per container savings. When you multiply these numbers by 100's and/or 1,000's this translates into $1,000 of dollars of annual savings. That is exactly what the market was able to do with this project.

The thing that makes this project even more special is that it can do the same for producers for decades to come. This project should show a 10% to 40% return on the investment for many, many years.

The other goal of this project was to assist the Market and individual farmers in becoming GAP certified. The Market is now GAP certified as well as 10 of the regions' producers. Thanks to this project and numerous others, several other growers are in the process of attaining GAP certifications. We are all concerned about food safety. This project helps to get even more products into new clean containers. Furthermore the GAP certification is an excellent marketing tool to assist us in moving the regions product.

IV. Beneficiaries

The monetary benefit of this project, thus far, has gone to the 18 growers who have taken advantage of this current inventory. This number will increase greatly over the next few years.

Indirectly the market benefits by having a new package to sell the regions products in. A good product in a nice container is always a plus in terms of marketing.

Indirectly the end consumer also benefits. The availability of reasonably priced new containers will deter growers from packing in used containers. While used containers are usually cheaper, the chance of passing bacteria on to the end consumer increases with the use of used boxes.

As more producers use this inventory; the benefits of the program continues to increase. Based on the data that we have acquired it appears that each time the $30,000 is reinvested in the next loads of containers, producers will save about $4,700. If we roll the $30,000 over 2 ½ times each year and for the next 30 years, the return on the $30,000 investment will be $352,500. Using the same additions, the roi annually could be as high as 40%.

V. Lessons Learned

Undoubtedly, this is an excellent project. Containers are critical input in the produce business. A good product in nice containers is much easier to market than a good product in a common container. Providing a critical input at a lower price automatically means a better net return to the producer. The only weakness to this project is that we need to continue to expand it.

Educational Opportunities for Farm Direct Marketers & Farmers Markets

Cathy Belcher
804-241-0368
cathy.belcher@yahoo.com

I. Project Summary

Direct marketing of agricultural products has grown to meet the needs of small- to medium-size family farms looking to sustain the farm and preserve farmland. Selling directly to the end user provides the farmer with more money for his products. Direct marketing also meets the needs of the local community, providing consumers, restaurant chefs and retail stores with a source of fresh product. The desire for fresh, safe and flavorful farm products has heightened, due in part to food borne illness outbreaks nationwide. Advocates of buying locally feel having a relationship with the farmer means fresher, safer food. This project had a three-pronged approach to bolster direct marketing in Virginia:

1. Develop an updated, revitalized Farmers Direct Marketing Association (FDMA) Web site. The site will focus on keeping direct marketers up to date on issues, provide tools and resources for growing their businesses, provide membership information, and alert them to meetings, workshops and conferences related to direct marketing and the production of specialty crops.

2. Develop a business-to-business Facebook page, where direct marketers can network with their peers, allowing them to share information and resources to benefit their operations.

3. Develop a series of workshops to benefit farm direct marketers and farmers markets. These workshops would provide direct marketers with information and resources for developing direct marketing operations, diversifying existing operations, locating markets, and effectively marketing their operations. Once developed, these workshops could be conducted across the state, based on the needs of the area.

II. Project Approach

Website – VFDMA prepared a Request for Proposals to find a Web designer to update the site. Based on the proposals, Chappell Graphics in Charlottesville was chosen. Working closely with VFDMA, Chappell designed a Website, using Joomla. The site is very attractive, but over time has proven to be very difficult to manage. In addition, the site went down several times and developed problems with the on-line membership and workshop sign-up page. After repeated attempts to work out the problems, it became clear that these problems would never be completely resolved. The VFDMA Board of Directors discussed this at length and decided to switch the site from Joomla to WordPress. Another RFP was prepared and sent out to Web design companies. VFDMA received seven proposals and chose Centressa to make the switch. The new site is scheduled for completion by the end of the year. While this part of the project did not go as planned, in the end, VFDMA will have the Website it needs.

Facebook – Due to time limitations, this phase of the project did not come to fruition. This will be done when the Website is completed.

Workshops – The VFDMA developed four workshops during the grant period. The first was a one-day workshop held in Charlottesville, offering low-cost, no-cost marketing ideas for direct marketers. Chappell Graphics presented to the more than 35 attendees. Evaluations were very positive and the workshop was a success.

The second workshop was held in Virginia Beach and featured nationally-known speaker, Harold Lloyd. The topics were "Am I the Leader I Need To Be" and "Creating a Great First and Lasting Impression." This was an excellent workshop for those attending. However, only 10 people attended. The workshop was well publicized, was held in an area that has many direct marketing operations, and at a time of year that many direct marketers had indicated was a good time for them.

The third and fourth workshops were "Farming the Internet" and "Farming is a Business." Farming the Internet was divided into basics and social media. This one-day workshop held at J. Sargeant Reynolds Community College provided a hands-on experience. The workshop was very well received, but attendance was low at 10 participants. The following day, VFDMA presented a workshop in Charlottesville at Piedmont Community College. This workshop included development of a business plan, setting up the business legally, and a session on using Quickbooks. Again, the workshop was very well received, but attendance was low at six participants. The workshops were held in March, which was a good time for direct marketers, and the workshops were well publicized.

VFDMA worked with VDACS, Farm Bureau, Virginia Tech, and the Virginia Beach Department of Agriculture to get the word out about the workshops, using their Websites and contacts.

Membership in the Virginia Direct Marketing Association, while not exclusively specialty crop growers, is predominantly specialty crop oriented. All members are involved in direct marketing and agritourism activities. Ninety-five percent of the membership are involved in the production and marketing of specialty crops. Diversification is key for direct marketers in sustaining their farms. For example, fruit and vegetable growers may also offer eggs or value-added products; Christmas tree growers offer wreaths and roping. Workshops provided for members of VFDMA were attended by 95% specialty crop producers. Non-specialty crop growers could not be excluded and were funded by VFDMA. VFDMA used membership dues and other funding sources to cover the inclusion of those producers who are not solely specialty crop producers.

III. Goals and Outcomes Achieved

VFDMA completed all but one of its goals for the project, as summarized above. A new Website was developed for the association and four workshops were conducted for direct marketers. The initial purpose of this grant project was to provide members and potential members with marketing ideas and resources to benefit their businesses. VFDMA felt that by providing valuable benefits to direct marketers, membership in the association would increase. VFDMA relies on memberships for its budget.

In 2010, when the grant was awarded, VFDMA had 84 members. In 2011, 82 farms/markets joined the association. In 2012, 79 joined. Newsletters, the Website, mailings to potential members, workshops, and attendance by the association at industry conferences and trade shows were attempted to encourage direct marketers to join the association. While new members have joined, previous members did not renew. One possible reason for this decrease over the last two years could be the economy. At the time of completion, VFDMA had 79 members. The membership for 2010 when the project began was 84.

IV. Beneficiaries

Direct marketers of specialty crops have benefited from exposure to marketing information and resources provided by the association. However, the number benefited was not as anticipated. Total workshop attendance was 61 direct marketers, which is a small percentage of this segment of the industry, which is estimated to be 1,700 statewide.

V. Lessons Learned

While the grant funds were beneficial to the VFDMA and the goals of the project were met, the number of workshop attendees and memberships were disappointing. VFDMA has discussed this and has tried to come up with solutions. VFDMA did learn a valuable lesson in Website development. Although, the association received a beautiful site, it was too difficult to maintain and was not user-friendly. It is important to determine the best platform for the Website, which will allow for easy upkeep and provide the services needed by members and potential members.

"If you build it, they will come," was the belief of VFDMA in developing excellent workshops, based on what direct marketers said they wanted. This was not the case. Solutions may be more lead time, better advertising, and developing partnerships with other related organizations.

Catherine Belcher
VA Farmers Direct Marketing Association
Cathy.belcher@yahoo.com

Increasing the Competitiveness and Consumption of Virginia Grown Strawberries

Gail Moody Milteer
757-569-1100
Gail.moodymilteer@vdacs.virginia.gov

Project Summary

Plasticulture strawberries, grown generally by small farm families in Virginia, are very expensive to grow but can be a profitable specialty crop with good management practices and productive sales. No crop insurance policies are available for strawberries making it a risky crop to grow. Each year during the short harvest season it becomes more difficult to get consumers to the farm to pick berries or purchase pre-picked berries. Many consumers do not know when local berries are available. The grant increased public awareness of the Virginia strawberry season and educated consumers on nutritional benefits as well as handling, storage and usage of strawberries. Due to the increased awareness and educational materials provided by the grant, growers experienced more on farm sales thus an increase in profit from their berries during the two years of the grant funding.

Project Approach

Efforts were made to update the department's list of strawberry growers in Virginia and to include their information on our website so consumers could easily identify farms and farm stands to purchase fresh, local strawberries. Each identified grower, approximately 60, was requested to submit a form to the Virginia Department of Agriculture and Consumer Services with the needed information so we could update and/or add their farm to our website. Growers not returning the forms were visited and completed the form during our farm visit. The number of strawberry farms on our website increased by 25%. Likewise, growers who were no longer in the business were removed from the site. Yearly the site is being maintained and updated to reflect the strawberry farms in Virginia.

In 2011 A "*Strawberry Time*" booklet was purchased to use with children coming to the strawberry farms. Rolls of "*I Love Local Strawberries*" were also purchased for use with children visiting the berry farms. A colorful brochure, *Virginia Grown Strawberries* outlining nutritional information, picking hints and storage information was developed, printed and distributed for use at the farm stands. A recipe brochure was developed in 2012 for use at the farms as a method to increase sales and to increase return customers to purchase additional berries. These marketing tools enhanced strawberry sales. Every strawberry farm in the state received these free items, provided by the grant, to use in their marketing efforts.

On peak production weekend in 2011 a 13 x 3 inch strawberry Post It Note was designed and affixed to the front page of over 500,000 main newspapers in the state in targeted areas on a Friday to promote local strawberry season and peak week. The Virginia Grown website address was used on the Post It Notes to encourage consumers to find a strawberry farm close to them. A few small ads were also used in highly concentrated areas. Likewise in 2012 ads were run in key newspapers announcing an early strawberry season. Several free TV news spots were achieved in efforts to alert consumers of the early berry season. Without such information broadcasted to potential customers the berries would have remained in the fields and rotted.

Goals and Outcomes Achieved

Growers have indicated favorable to media promotional efforts as an increase in business was seen immediately following newspaper ads and articles. Most reported between 15 and 20 % increased traffic after the media blitz. Website traffic for strawberries also increased during the season which helped consumers find farms close to them. Consumers loved picking up nutritional information and recipes which expand sales.

Growers learned that point of purchase promotional materials were well received by those arriving at the farm to pick berries and many customers made repeat visits thus resulting in increasing sales.

In teaming up with a local newspaper in a heavy berry growing area and offering a recipe contest we were able to keep free media stories in front of the potential customers. The recipe contest winners received a gallon of fresh strawberries and their recipe was featured in a large local newspaper.

Over 50% of growers participated in a simple survey that indicated all promotional materials were well received by customers and helped in educating the customer. All farms reported additional sales based on the ads and many commented that customers often had the ad from the paper cut out and with them when they came to buy strawberries.

Some growers indicated that they would start using recipes and other promotional materials at their farm gate as it helped with increase sales and customers looked forward to the free promotional items.

Strawberry growers surveyed did meet the Target Performance Measure of increasing on farm sales by a minimum of 20% over sales from the previous year. Seasoned growers saw an increase in repeat customer sales as well as some new customers and contributed the increased sales to advertising berry season along with increased information on simple ways to use strawberries. Newer growers that had not implemented marketing tools saw the largest boost in sales. In offering educational, nutritional, and child friendly materials u-pick customers often returned for a second picking and/or told friends about the strawberry farm. On days following the media blitz sales skyrocketed.

Beneficiaries

Naturally the growers benefited from the project. Most small family farms do not have the money to heavily publicize their strawberry business so the grant provided great advantages to them. It also strengthened the working relationship between VDACS and strawberry growers though out the state. Most growers unless they are in a direct marketing group would not buy booklets to distribute to children, or invest in nice recipe brochures to give out at their farms. However by grant funds providing these marketing tools to all strawberry growers in our state it allowed the grower to test the use of such tools and see what was well received. Hopefully items

that worked well for the individual farms might be incorporated in their family strawberry business in future seasons.

Likewise the consumer benefited from the grant. They were alerted to the local strawberry season, in 2012 made aware that the season was several weeks early, provided with nutritional information and recipes. Young children were delighted to receive a "I Love Local Strawberries" sticker and a "Strawberry Time" booklet to help them learn more about strawberries and agriculture.

Sixty six strawberry growers in Virginia benefited from the specialty crop grant. Each grower received marketing materials to use at their farm and benefited from the strawberry season advertising as well as being listed on the VDACS Virginia Grown website. Estimated statewide increased sales of over $400,000 were attributed to the project's marketing efforts.

Lessons Learned

Many consumers that want to buy local fresh strawberries do not know how to pick them or use them so the educational information was very useful to them. In providing recipes and simple ways to use berries sales increased and it was noted that repeat customer business increased.

Young families with children were excited to be given booklets geared to the young child to begin the educational process on learning how strawberry plants grow. They also welcomed the "farm experience" as a family outing.

Growers learned that they must get the word out to their customers that the berries are almost ready and ready for picking. Many are now tracking the customers and trying to use social media to keep their farm products in front of potential customers. Some are now incorporating recipes and helpful hints on their websites.

Additional Information

Remaining inventory of printed and purchased promotional items will be distributed to farms across the state in 2013 until the inventory in depleted.

VDACS website will continue to be updated yearly for strawberry locations.

The original grant award amount was for $48,239.10. As of October 31, 2012 the remaining balance was $77.70. All grant expenditures have been completed.

Beautiful Gardens® Plant Breeder Workshop

Alex Niemiera
540-231-6723
niemiera@vt.edu

I. Project Summary

Ornamental plants comprise a significant portion of Virginia's specialty crops. In 2008, cash receipts for nursery and greenhouse plants accounted for 64% of the total value of those specialty crops. (http://www.nass.usda.gov/Statistics_by_State/Virginia/Publications/Annual_Statistical_Bulletin/pg72-7309.pdf) An important segment of the nursery industry is new plant introductions that are developed by plant breeders, both professional and amateur, or discovered as chance hybrids in gardens and in nature. The demand for new plant introductions has steadily increased over the past several years as the gardening public has shown an increasing appetite for the newest and greatest. Recognizing this important and lucrative market segment, the Virginia Nursery and Landscape Association (VNLA) has partnered with the Department of Horticulture at Virginia Tech, the Institute for Sustainable and Renewable Resources (ISSR) at the Institute for Advanced Learning and Research (IALR) in Danville, VA, Norfolk Botanical Garden, the Virginia Department of Agriculture and Consumer Services (VDACS), the Virginia Master Gardener Program, Virginia cooperative Extension, the Claytor Nature Study Center at Lynchburg College, Bedford, VA, and J. Sargent Community College, Goochland, VA to implement the production, management and propagation of new plant introductions through Beautiful Gardens®.

The primary foci of Beautiful Gardens® are to 1)seek out new to the trade ornamental plants, 2)evaluate their landscape and production performance, 3) organize the commercial propagation of selected plants, and 4) develop promotional materials and programs in support of sales. Beautiful Garden® plants are distributed to wholesale and retail nursery operations throughout Virginia.

A key component of the Beautiful Gardens® program is the acquisition of new plants (taxa, i.e. genera, species, varieties or cultivars). Sources of new taxa for the program have been arboreta, plant collection trips and plant donations from nurseries and private collections. While these sources generate potential new plants for the nursery industry, Beautiful Gardens® needs a much larger pool of plants to be evaluated for potential release into the nursery industry. In Virginia, there are many people, such as Master Gardeners, horticulturists and home gardeners, who have both the desire and potential skill to breed plants. By educating interested people on the fundamentals of ornamental plant breeding, Beautiful Gardens® could potentially generate a group of amateur breeders who could develop new and improved plants. To this end, the grant, *Beautiful Gardens® Plant Breeding Workshop*, allowed for the development of educational materials and for conducting a number of plant breeding workshops throughout Virginia.

II. Project Approach

Staff from Beautiful Gardens®, the Virginia Tech Department of Horticulture and the Virginia Department of Agriculture and Consumer Services worked together to design a program and educational materials for use at the breeder workshops and as take home reference materials. Workshops would include a basic review of the botany of plants, a hands-on actual crossing (pollen to pistil) of plants, what to do with the new seeds created, and information about Beautiful Gardens® and their follow up program for evaluation and promotion of any new plants generated. Workshops were planned for regional areas of the state – Blacksburg, northern Virginia, the Tidewater area, Richmond, Charlottesville and Southside.

Workshops were conducted by Lisa Lipsey, the Beautiful Gardens® Program Coordinator, Dr. Alex Niemiera, Associate Professor of Horticulture, Virginia Tech Department of Horticulture, and additional staff from the Department of Horticulture. Each workshop was promoted and advertised by Beautiful Gardens®, the Virginia Nursery and Landscape Association, the Virginia Department of Agriculture and Consumer Services, the Virginia Cooperative Extension Service, Master Gardeners and other cooperating partners of Beautiful Gardens®.

Future contact with workshop attendees is to be maintained in order to answer any questions and to review the status of their plant breeding activities.

III. Goals and Outcomes Achieved

Goal: Develop highly informative and easily understandable workshop educational materials

Dr. Alex Niemiera and Lisa Lipsey designed and developed a program with supporting educational materials for Beautiful Gardens® Plant Breeding Workshops entitled *"Breed Plants for Fun and Profit"*. A PowerPoint presentation was designed to introduce attendees to the basics of plant breeding including flower morphology, plant genetics and heredity, breeding techniques, and plant propagation. The materials were supported by real-life breeding examples, plant breeding quest speakers, and plant breeding videos. An extensive take-home booklet was developed that contains numerous articles on each of the main topics presented during the PowerPoint as well as articles that cover specific plant species with breeding objectives and outcomes.

Pre and post workshop surveys were developed to assess both the knowledge and interest of attendees. Results from these surveys indicated that the majority of attendees came into the workshops with little knowledge of any aspect of plant breeding but left with significant gains in knowledge and enthusiasm for future plant breeding projects.

Following the classroom portion of each workshop, attendees were given plants to practice plant breeding techniques. Plant species were carefully selected prior to the date of each workshop to ensure that plants were flowering, pollen was being produced and flower parts were easily recognizable by the amateur breeder. This activity took considerable time and coordination.

As an added dimension, we had two experienced plant breeders come to some of the workshops to discuss their own specific breeding programs. Mrs. Linda Pinkham, daylily breeder, presented her work during the workshop at Norfolk Botanical Gardens. Mr. Bill Smith, magnolia breeder, also presented at Norfolk and two others – at Lewis Ginter Botanical Gardens in Richmond and at Merrifield Garden Center in Gainsville. We received highly favorable comments from participants on the inclusion of breeders speaking on their specific programs.

Goal: Conduct six plant breeding workshops throughout Virginia
Six workshops were promoted and advertised during the grant period; however, only five of the six were conducted. The workshop scheduled for May 4, 2012 in Abingdon, Virginia at the Southwest Virginia Higher Education Center was cancelled since it did not attract our required minimum number of attendees.

Following is a list and brief description of each of the workshops.

Norfolk Botanical Garden, Norfolk, VA April 18, 2011

Advertising for the Workshop was accomplished through the NBG website, through emails sent to Master Gardeners in surrounding cities and counties, and by emails sent to the membership of The Virginia Society of Landscape Designers. We had 10 participants, many of which were Master Gardeners, most with little or no plant breeding experience. Lunch was provided and workshop plants were taken home by participants along with the reference booklet. Extensive help with logistics and operation was given by Velva Groover, Senior Research Assistant, Virginia Tech Department of Horticulture.

Virginia Tech, Master Gardener College, Blacksburg, VA June 23, 2011

Advertising was accomplished through the Master Gardener website specifically designed for the annual Master Gardener College on the Virginia Tech campus. We had 11 participants, all Master Gardeners, who had some prior knowledge of most of the topics covered. Suzanne Piovano, Senior Research Technician, Plant Tissue Culture Lab, Virginia Tech, presented the hands-on portion of the workshop. She brought extensive knowledge from her work on potato breeding.

Lewis Ginter Botanical Garden, Richmond, VA September 9, 2011

Advertising was accomplished through the Lewis Ginter website, the Virginia Cooperative Extension list serve, and emails sent to Master Gardeners from Coordinators in surrounding counties. We had 23 participants which was the maximum number we could accommodate. Bill Smith presented his work on magnolia breeding, and as at the Norfolk workshop, lunch was provided; Workshop plants were taken home along with the reference booklet. From the exit surveys, we discovered the most valued aspect of the workshop was hands-on work.

Merrifield Garden Center, Gainsville, VA October 14, 2011

Advertising was accomplished through the Merrifield Garden website, the Virginia Cooperative Extension list serve, emails to Master Gardeners and by emails sent to the membership of The Virginia Society of Landscape Designers. We had 11 attendees, all Master Gardeners from surrounding counties of Orange, Fauquier, Madison and Fairfax. Organization and assistance by Velva Groover was essential to smooth functioning, and Bill Smith again presented his work on magnolia breeding. His slide presentation given in previous workshops was revised and formatted into a PowerPoint presentation by Lisa Lipsey. Again, we received excellent reviews for the overall value of the entire workshop.

Hahn Horticulture Garden at Virginia Tech May 10, 2012

Advertising was through the Hahn Garden website and membership and volunteer list serve. We had 10 attendees with a diversity of interest and experience with plant breeding. Our PowerPoint presentation was slightly abbreviated in order to have more time for the hands-on portion of the workshop which many participants in the past had expressed being very valuable .

Goal: Modify workshop content and delivery

In order to assess the effectiveness of content and content delivery of each workshop subsection, we developed a detailed survey with numerical ratings from 1 (poor) to 4 (excellent) as well as specific questions designed to determine what parts of the workshop were most and least valuable. Following each of the presented workshops, we reviewed all exit surveys to determine what areas we needed to change or to improve. Because of responses to the first workshop survey, we added more information and explanation on the plant evaluation process, we added greater detail on flower structure to include plants in the *Asteraceae* family, and we allowed more time for the hands-on portion of the workshops after many participants indicated this had the greatest value to them.

Goal: Receive no less than 3 (good) ratings on exit surveys for each workshop subsection and for the overall workshop evaluation

Our post workshop survey rated each subsection, the PowerPoint presentation (classroom style) and the hands-on breeding techniques with blooming plants. Here is the question that was posed:

How would you rate the instruction in this course (1 = poor; 2 = fair; 3 = good; 4 = excellent)?

PowerPoint Presentation	1	2	3	4
Hands-on plant breeding session	1	2	3	4

Data from all workshops indicated that 14% of respondents rated the PowerPoint presentation as good (3/4) and 84% rated the PowerPoint as excellent (4/4). On the Hands-on session, 3% of respondents rated the session as fair (2/4), 24% rated it as good (3/4), and 73% rated it as excellent (4/4).

We included a question to determine the overall evaluation of the workshop.

What is your overall evaluation of the workshop (1 = poor; 2 = fair; 3 = good; 4 = excellent)?

Data from all workshops indicated that 12% of the respondents rated the workshop as good (3/4) and 66% rated it as excellent (4/4); twenty-two percent did not respond to the question because in two of our workshops, the post workshop survey was printed double-sided and several participants did not realize that questions 7 and 8 were questions on the back.

Goal: Maintain a master list of workshop participants for future communication

We have a master list of all workshop participants with name, address, phone number and email address. Follow up contacts will be made to see if any are using the information presented in the workshop, to answer any questions and to keep up with any breeding work they may be doing.

IV. <u>Beneficiaries</u>

Workshop participants, many who are Master Gardeners, benefited from the workshops by increasing their plant breeding knowledge, understanding, and skills. In our pre-workshop survey, participants were asked to rate their knowledge and/or skill (none, little, moderate, extensive) in five aspects of plant breeding – plant anatomy, plant sexual reproduction, heredity information, breeding techniques/objectives, and plant evaluation. The majority rated themselves as having little to no experience in all of the five aspects. Following the workshop, people were asked in the post-workshop survey to rate their gains in knowledge and/or skill on the same five aspects of plant breeding. An overwhelming majority rated their gains as moderate or extensive.

Workshop locations benefited from having new and unique educational programs.

Beautiful Gardens® greatly benefited by teaching participants a skill that could be used to develop new and improved plant varieties. The introduction of new plants into the Virginia nursery industry is a key factor for the continued success and growth of the Beautiful Gardens®' program, and with the success of Beautiful Gardens® comes expanded markets and plant sales for the Virginia nursery industry. In addition, workshops increased awareness and visibility of Beautiful Gardens® as a local and trusted program for introducing and recommending plants for Virginia gardens.

The Virginia Nursery and Landscape industries are potential benefactors since workshop participants may produce new-to-the-trade plant species. However, the realization of this benefit may take several years since the minimum time from plant breeding, new plant generation, plant evaluation, and plant introduction is a minimum of four to five years.

V. Lessons Learned

The structure of the workshops worked very well with the classroom (PowerPoint) instruction being presented in the morning, followed by lunch with the hands-on portion during the afternoon. The time four-hour time period was appropriate to present information as well as to maintain interest and enthusiasm.

Our reference booklet provided more detailed information than was presented during the workshop. There was a section that contained articles on breeding specific plants which could be used to structure and organize participants own breeding projects. Other sections, such as Flower Structure, Pollination and Fertilization, and Heredity, supported with numerous articles the information that was presented in the PowerPoint. All participants were greatly appreciative of their new knowledge and experience.

Having plant breeders Linda Pinkham and Bill Smith present their breeding programs added a new, real dimension to the information being presented.

The attendance at some of the workshop was less than anticipated. This could be due to a number of reasons: 1) the workshops are an all-day commitment, 2) they are given on a weekday rather than on the weekend, and 3) the topic of plant breeding is very specific. When

organizing the logistics, we discovered that in order to work closely with the participants during the hands-on portion we would have to limit the number of people. This limitation was somewhat of an advantage since participants greatly appreciated the individual attention they received when practicing the plant breeding techniques.

VI. Additional Information

Because breeding a new plant takes many years from making the initial cross to the possible selection of a new and worthy plant, activities that were begun during the grant period must be followed. All participants will be contacted on an annual basis to determine if they are involved in breeding and if Beautiful Gardens® can help in any way.

Advertisement for Norfolk Botanical Garden workshop:

BEAUTIFUL GARDENS
grow with confidence ®

Breed Plants for Fun and Profit

Where: Norfolk Botanical Gardens
When: Monday, April 18, 2011
Time: 10 am – 3:00 pm
Cost: $95 ($65 for Garden members)

Plant breeding is an exciting combination of science and art where relatively simple techniques can produce new plant varieties. In association with Virginia's plant introduction program, Beautiful Gardens®, Virginia Tech Horticulture Professor, Dr. Alex Niemiera, will introduce participants to the fundamentals of plant breeding. Topics covered include plant selection and reproduction, heredity, general breeding techniques, breeding objectives, and evaluation of new plants. Following classroom instruction and a lunch break, participants will work with a number of plants on cross-pollination techniques.
Linda Pinkham, daylily breeder and inventor of Beautiful Gardens® first new plant introduction, *Hemerocallis* 'VT Spirit', and Bill Smith, magnolia hybridizer from Richmond, will discuss their breeding work and be on hand to help with understanding techniques and objectives.
This four hour workshop will provide participants with the basic knowledge necessary to successfully select and improve desired traits of ornamental plants. Perhaps you will generate a new plant that will be introduced into the garden center trade and turn a profit as well!
Fee includes: lunch, reference materials, and plants to take home.
Maximum of 30 participants
Pre-registration is required.

Please visit Norfolk Botanical Gardens' website to "book a class"
http://www.norfolkbotanicalgarden.org/programs-events

For more information, please contact:
Lisa Lipsey, Beautiful Gardens® Program Coordinator
Virginia Tech, Department of Horticulture
540-231-6961
llipsey@vt.edu

Increasing GAP Certification Readiness among Organic and Conventional Growers and Nutrition Knowledge and Consumption of Specialty Crops among Children and Adults in Southwest Virginia

Kathlyn Terry
276-623-1121
kterry@asdevelop.org

I. PROJECT SUMMARY

This project addresses two separate issues: aiding farmers in obtaining Good Agricultural Practices (GAP) certification and providing increased access to nutrition education information and healthy fresh food.

A. Background and Initial Purpose

GAP

This project addresses a growing area of concern for growers and produce handlers in Virginia. Increasingly, wholesale buyers of fresh produce are demanding that food safety practices are followed (and certified) by their producers. These GAP (Good Agricultural Practices) and GHP (Good Handling Practices) certifications are often viewed as confusing and expensive impositions by farmers, many of whom are wary of increased regulation upon their businesses. The fact remains that food safety regulation is not going away (and can lead to simple changes in farming operations that do address the safety of the food that is grown in Virginia). It is a reality that must be addressed.

Nutrition Education & Access to Fresh Food

National and regional reports have documented the obesity rate and associated illnesses in this region of central Appalachia. Other studies demonstrate a relationship between poverty and poor health. An important issue that low income persons are faced with is the high cost of fresh vegetables compared with processed food. Access to fresh, healthy food and an awareness of specific health benefits of including fresh vegetables in our diets was a need that we observed among food pantry recipients. Healthy Families ~ Family Farms (HFFF) carried out the ***Here's to Your Health Campaign*** to address these needs.

B. Motivation

GAP

This project is particularly timely in that farmers are struggling to meet the Good Agricultural Practices standards set forth in the Food Safety Modernization Act. Many wholesale buyers are either currently requiring GAP certification or are providing ASD with a small amount of time to train the farmers who grow for the Appalachian Harvest enterprise before they will require it. In fact, in 2012 all but two Appalachian Harvest wholesale buyers will require GAP certification. This represents 77% of the demand for organic produce through Appalachian Harvest. Our largest buyer has worked with us for as long as they can – in fact our group of farmers is the last to become certified. This project was designed to make GAP certification accessible to farmers by providing a step-by-step guide for implementing GAP on their farms. Doing so will keep AH farmers from losing the lucrative wholesale markets currently available to them.

Nutrition Education & Access to Fresh Food

Large numbers of folks coming to local food pantries exhibit many of the health issues referred to in regional and national reports. Diabetes, obesity, heart disease and high blood pressure are common among food pantry recipients in our region. Ironically, food pantries are able to distribute mostly processed food – canned or boxed – not fresh. The need for the addition of fresh vegetables was apparent in order to help people begin to think of their own diets in terms of the USDA recommendations. By raising awareness of specific health benefits of the fresh vegetables provided through HFFF and encouraging creative ways to incorporate these specialty crops into their diets, the *Here's To Your Health*

Campaign encourages the increasing number of people forced to rely on food pantries to include fresh vegetables in their diets on a regular basis and helps people to plan for ways to do that.

II. PROJECT APPROACH

A. Summary of Activities and Tasks Performed During Grant Period

GAP

ASD staff worked with Virginia Cooperative Extension to identify farmers in need of GAP training and deliver that training to 74 farmers in 4 training workshops held in Ashland, Abingdon and two classes in Duffield, VA. The training was developed by Extension and supplemented with App. Harvest's "in-house" program that incorporates the NOP, with the goal of helping farmers to pass a GAP audit – in other words, to achieve a score of 80% or greater. The training was not designed to achieve a score of 100% as that would increase costs to farmers significantly with little return on that investment for them in the short run.

Every attendee was provided with a GAP manual that included forms, signs, procedures, and everything needed to implement GAP at their individual farms. Included in the manuals was a CD of the electronic versions of the forms in the manual. The workshops consisted of 8 hours of classroom training followed by a 2 to 3 hour on-farm segment. The on-farm segment is an invaluable piece of training, as it allows farmers to see how the classroom training is implemented on the ground. It brings the process to life.

As a part of the classroom training, growers conducted an initial self audit to determine areas on which they must focus in order to pass an audit. This fall growers will conduct another self audit to assess their progress and to ensure their readiness for an audit.

Due to the practical nature of this training and the fact that growers can clearly see how they can implement these changes on their farms, the training has been very well received. Several farmers commented on how the combination of classroom training, the comprehensive manual and CD, followed by the on-farm instruction brought everything together for them and made it easy to understand. Hanover County tomato producer, Mrs. Dodd, said, "I don't know if I should kiss you or do my paperwork first, but thank you!"

B. Role and Significant Contributions of Project Partners

GAP

Virginia Cooperative Extension:

- Virginia Cooperative Extension has been a key partner in this project. They developed and delivered GAP training, working with ASD staff to identify appropriate audiences.
- Recently Extension and Appalachian Harvest have begun to assist farmers with preparing their individual farms for inspection.

Nutrition Education & Access to Fresh Food

Ecumenical Faith in Action (EFIA) Food Pantry:

- The Director and staff of EFIA assisted in the planning the format of the survey to be conducted in their pantry. Logistical and personal concerns for participants' attitudes toward the activity were considered and this helped in getting the survey just right for the population.

Healthy Families ~ Family Farms Volunteer Committee

- The HFFF committee consists of a variety of local people including two nurses, a dietician, Feeding America program coordinator, librarian, college professor, Elder Spirit community leader and church justice advocate. Committee members assisted in the planning of the survey format and the approval

of nutrition education materials. They also participated in the food events and in conducting the survey.

Feeding America Southwest Virginia Food Bank

- The Food Bank Program Coordinator assisted in the planning of the format of the survey and served as a consultant to the HFFF program coordinators.

III. GOALS AND OUTCOMES ACHIEVED

A. Activities Completed

GAP

- From January until present ASD has hosted 4 GAP training sessions and trained approximately 75 local organic and local conventional growers. Twenty-two of those growers were from the Richmond area and approximately 18 of them have become GAP certified this year.
- Appalachian Harvest has 1 GAP certified producer for both organic and conventional and 7 – 8 who are receiving one-on-one support from ASD staff and Extension in order to support their anticipated GAP certification in 2012.
- A partnership was established between the Grand Rapids Community College, the Wallace Center, Appalachian Sustainable Development, and Virginia Cooperative Extension for the purposes of creating a training course modeled on the training and certification process being delivered through AH.

Nutrition Education & Access to Fresh Food

Media Campaigns

- Over 1,000 brochures were distributed in three Southwest Virginia area food pantries, an elementary school and a Head Start program. These brochures indicated where to obtain a variety of specialty crops, their nutritional value and simple recipes. A brochure was also distributed reminding people of how to utilize the SNAP benefit at local farmers' markets.
- Refrigerator magnets were created and distributed in three Southwest Virginia area food pantries, an elementary school and a Head Start program. These magnets provided a reminder of the nutrition value of specialty crops as well as where to obtain them, and a reminder of utilizing the SNAP benefit at area farmers' markets.

Community Food Events

Here's To Your Health 2011 Nutrition Survey at the Ecumenical Faith In Action Food Pantry (EFIA) (Abingdon, Virginia)

- The staff of HFFF and volunteers conducted a conversationally styled survey of 100 EFIA food pantry participants to measure their knowledge of the nutritional value of the Appalachian Harvest specialty crops of tomatoes, green peppers zucchini and yellow squash.
- Nutrition Education during the survey included the HFFF staff and volunteers sharing information one-on-one with food pantry participants. Nutrition handouts specific to the selected vegetables, and information on utilizing the SNAP EBT benefit at the local farmers' markets were also given to participants.
- 10 food events took place on different days of the week and different times of day at the Ecumenical Faith in Action food pantry during the months of May 2011-July 2011.
- Here's To Your Health 2011 EFIA Food Tasting

  Samples of 3 different specialty crop dishes were served to participants to try Recipes for each sample were provided.

- Newspaper Article describing the experience and results of the Here's To ***Your Health Campaign*** project was published in the Washington County News September 07, 2011 issue and the Bristol Herald Courier September 12th, 2011.

B. Comparison of Actuals to Goals

GAP

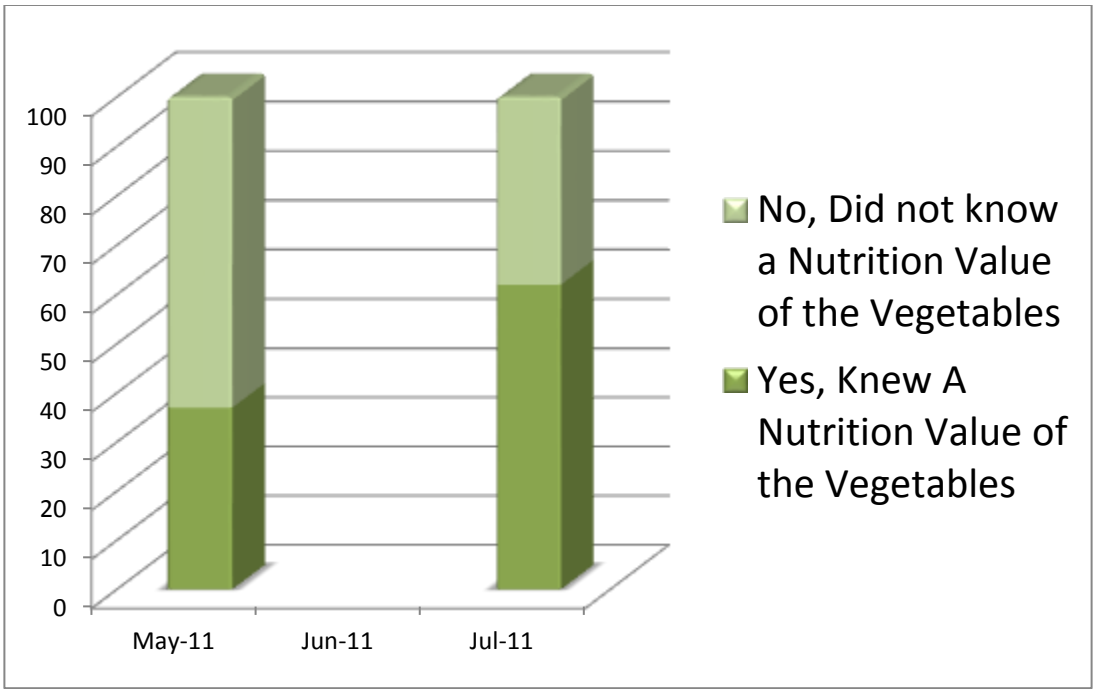
- 74 famers were trained vs. a target of 75. This project will continue, however, and we anticipate reaching far more farmers in 2012. ASD and Extension staff are still working with farmers to complete the second self-audit. We expect that they will be completed by February of 2012

Nutrition Education & Access to Fresh Food

- A Baseline Random Sample Survey of 100 clients of the EFIA food pantry to determine knowledge among the attendees about the nutritional value of specialty crops available at the pantry provided benchmark data. The goal was to yield a benchmark change of 50% by the end of the project.
- Nutrition Conversations and media campaign as mentioned earlier; distribution of printed nutrition information and healthy recipes incorporating fresh specialty crops.
- Follow-up Random Sample Survey of 100 clients of the EFIA food pantry
- Food Tasting at the EFIA food pantry
- Newspaper Article

The goal of the ***Here's to Your Health*** nutrition campaign was to increase the baseline knowledge level at the end of the project by 50% and this goal was met.

- Baseline Random Sample Survey Initial Results: 37% of participants knew a nutrition value of the selected vegetables.
- TARGET: After one year, there will be at least a 50% increase in knowledge of the nutritional value of specialty crop vegetables among low-income, underserved people in Southwest Virginia, as measured by a random sample survey of food pantry clients.
- END RESULTS of Follow-Up Random Sample Survey : 62% of participants knew a nutrition value of the selected vegetables, a 68% increase in the baseline knowledge



C. Lessons Learned

GAP

- Providing growers with a manual and CD to help them implement GAP policies on their farm is a huge step towards helping them to become certified. However, we have found that many farmers need help capturing their own farm's Standard Operating Procedures in an acceptable format. They understand what needs to be done, just not exactly how to put that into words or capture it so that it will be acceptable to the auditor. We have found that with a modest investment of time from Extension and ASD personnel, this is fairly easily addressed. Additionally, helping farmers with appropriately scaled compliance is a very helpful to them. We have produced small scale, portable models for easy implementation for on the farm use.
- Not most, but ALL farmers hate being taxed with more paperwork.
- The minimum of 12 hours of training is necessary to cover the minimum requirements for farmers to become GAP Certification ready: 8 hours in a classroom setting and 4 on the farm. Coordination of this with most farmers having supplemental jobs can be challenging.
- Forming a partnership with Extension, AH, farmers and buyers is key to getting everyone on the same page. Training and follow up partnerships with Extension, and helping the buyers to understand the process helps the buyers to "feel the pain" of the farmers.
- One size actually does fit all with certain processes. Regardless of farm size or scale of production, on-farm Standard Operating Procedures for hand washing techniques, visitor logs, and personnel training are no different from large scale operations. The important thing is to streamline these type of processes for farmer, allowing them to easily adapt or tweak training materials to suit their needs.
- With other issues, one size does NOT fit all, therefore other SOP's and on the farm processes must be customized. The time required to work with each farmer and review their processes and then translate this information into presentable and workable documents can be challenging.

- Creating the document and processes is just the first step. Reinforcing that it is a living document and must be maintained and followed in practice is an ongoing and continued process and on-the-farm follow up by qualified individuals is challenging with small staff.
- Small scale farmers that are already organic have a 42 page application. Therefore GAP is another added expense with no additional return on the wholesale to retail markets. It increases your marketability, but not necessarily pricing.

Nutrition Education & Access to Fresh Food

Insights from project staff into positive and negative lessons learned.

- The overwhelming number of low income participants in the project suffered from major health issues. This reflects the findings of current studies that make connections between poverty and poor health, and diet and health.
- A majority of food pantry clients and other low income participants are interested in learning more about the health benefits of eating fresh vegetables. Healthy Families Family Farms will continue to make nutrition information available to food pantry clients and other low in come community members.
- A majority of participants prefer to include fresh vegetables over processed foods in their diets.
- The major barrier for low income people to including more fresh vegetables in their diets is cost. The lack of access to fresh food among low income community members is a major concern. The Healthy Families ~ Family Farms program will continue to work with community partners to increase access to fresh food for low income people.
- One-on-one conversations are more effective than just print information in helping people to explore nutrition and health issues in a way that affects them personally.

Unexpected outcomes or results

- Many low income participants became aware of the increased benefits of using SNAP at the farmers' markets. Many local farmers' markets double SNAP benefits. In spite of local promotion of this benefit many participants in the *Here's to Your Health* Campaign were unaware of this.
- The *Here's to Your Health* staff became aware of the hesitancy of many low income people to approach farmers' markets. There seemed to be a misconception that these markets were upscale markets that were out of their range. HFFF provided information and encouragement one-on-one to food pantry participants about shopping at farmers' markets.

IV. Beneficiaries

GAP

- Five years ago ASD developed a version of GAP training in order to assist Appalachian Harvest farmers in meeting the food safety requirements put forth by some of its buyers. As such, the original beneficiaries of this training were AH farmers. As a part of this project ASD expanded its audience and worked with farmers who grow for one of its buyers, Produce Source Partners, thus benefiting both Produce Source Partners (a strong supporter of ASD and long time AH buyer) and its farmers.
- Implementation of a GAP training program ultimately benefits AH buyers as well as its farmers, as it provides them with a means of offering local produce from a reliable source. This work has assisted farmers with a more detailed picture of their farming operations and has helped shift the liability away from the farmer. It has also helped to improve our buyer's confidence in Appalachian Harvest as many buyers have referred growers to us for training and certification guidance.

Nutrition Education & Access to Fresh Food

- Clients at the Ecumenical Faith in Action Food Pantry in Abingdon were a major group benefiting from the completion of the project's accomplishments. Food pantry clients are low income families who qualify to receive food assistance. A majority receive Supplemental Nutrition Assistance Program (SNAP) benefits. The group served at EFIA consists of a broad range of ages from young families to older senior citizens.
- Clients at other food pantries in Washington and Lee Counties also received the nutrition information.
- Parents at Stickleyville Elementary School and Head Start parents in Lee County received the nutrition information.
- Another group that benefited was local growers at local farmers' markets. Food Pantry clients were given information and encouragement to use their SNAP benefits and senior coupons to buy fresh vegetables at the markets. The Abingdon Farmers' Market manager reported an increase in the number of clients using these benefits at the market.

Quantitative Data concerning beneficiaries or the potential economic impact of the project.

- Over the course of the project 1000 food pantry clients and low income parents at an elementary school and Head Start program received printed nutrition information. 400 food pantry clients participated in four food events which included food tasting as well as information about the nutrition benefits of eating fresh vegetables. 100 elementary school parents and 30 Head Start parents participated in a one-session presentation about such benefits. All participants also received information about using SNAP and Senior Coupons at local farmers' markets.
- One potential economic impact of the project is increased revenue for local growers from people using SNAP and Senior Coupons at farmers' markets.

Handling and Use of Poultry Litter Incineration Ash Byproducts as Organic Fertilizer in Fresh Market Tomato Production

Sara Reiter
757-787-2786
esrcd.sara@gmail.com

1) Project Summary

The goal of the project was to determine whether predictable phosphorus (P) fertilizers for fresh market tomatoes could be derived from poultry litter ash byproducts. Various systems exist that aim to harvest energy from poultry litter; with nutrient rich byproducts being manufactured. A potentially significant outcome of converting animal waste to energy is the ability to concentrate plant available nutrients from poultry litter into concentrations that permit more precise application and/or that can be economically transported out of the watershed. Using these nutrients on lands that are currently not-available for poultry litter applications or transporting nutrients out of the watershed are the only positive way to solve the nutrient overloading issue and correct the overall watershed mass balance (what comes in →must go out!).

Virginia produces 6,000 acres of tomatoes annually with an annual farm gate value of $100 million (averaged over the last five years). Most of this crop is grown in Accomack and Northampton Counties on the Delmarva Peninsula where fresh poultry litter is readily available; however, fresh poultry litter cannot be used on vegetable crops due to food safety concerns. Conversion of poultry litter to ash byproducts may be the answer as microbial subjection to high heat will ultimately kill harmful microbial actively. The perfect storm has developed where rising fertilizer costs, interests in energy generation from renewable sources, and surpluses of fresh poultry litter in areas with high soil test phosphorus means that interests abound regarding nutrient cycling of organic fertilizer sources.

2) Project Approach

Five different fertilizer byproduct sources were manufactured using pre-commercial energy extraction technology. These technologies include: combustion via a poultry litter furnace (Ash1), combustion via a fluidized bed (Ash2), and gasification (biochar). The different technologies resulted in differing nutrient concentrations (Table 1 and 2 for 2011 and 2012, respectively). The poultry litter byproducts were compared to fresh poultry litter taken directly from a commercial poultry farm (PL) and commercially available triple super phosphate fertilizer (TSP; 0-46-0). Each fertilizer source was incorporated into Bojac sandy loam at the Virginia Tech Eastern Shore Agriculture Research and Extension Center at 3 different phosphorus rates (40, 80, and 120 lbs. P_2O_5/acre). A 0-P fertilizer control was also included. Tomato beds were formed and covered using polyethylene mulch after fertilizer incorporation. Nitrogen, potassium, and other nutrients were applied and/or fertigated according to Extension recommendations (VCE publication #456-420). Yield was collected and fruit graded according to size. Yield data was statistically analyzed using ANOVA and nonlinear regression procedures. Preliminary yield data was presented at several events throughout the study that included farmers, agency personnel, as well as other stakeholders.

3) Goals and Outcomes Achieved

GOAL 1: Develop techniques to improve handling of poultry litter incineration by-products for use as a pathogen free organic phosphorus fertilizer in vegetable production.

In order to address the questions surrounding the handling and nutrient availability of byproducts, project leaders developed a number of collaborations throughout the granting period. Researchers, commercial gasification companies, poultry farmers and local fertilizer companies were engaged to determine the need, concerns and views on use of ash and biochar as potential fertilizer products. One of the main observations throughout the study is that the PL byproducts must be reformulated to ensure a safe and consistent application. Small plot work conducted at the Virginia Tech Eastern Shore AREC was implemented on a day with no wind, buckets were held close/touching the ground, and significant byproduct dust was still blowing (Fig. 1).

Locally within Virginia, a private fertilizer company has expressed interest in assisting with various granulation and pelletization procedures to help make an affordable and nutritionally sound byproduct fertilizer. We have had several meetings with this company and they assisted with writing a grant proposal from the National Fish and Wildlife Foundation that was successful for $180,000 to focus on furthering ash research. The private fertilizer company agreed to provide in-kind cost share for the grant by donating use of their bench scale granulation equipment. We have conducted very limited testing of granulation in the laboratory with one of the ash products and found that we could produce a granular product. This project was also used to leverage interests for a USDA-NRCS-CIG proposal for bringing manure to energy products to Virginia. Specifically, $20,000 of this grant was set-aside to further by product research from different energy systems with the bulk of that grant going to assist with installation of five different manure to energy projects throughout the Chesapeake Bay watershed ($750,000 grant costs = ~$2 million total project).

Internationally, Dr. Mark Reiter and Mrs. Sara Reiter traveled to Ireland to discuss poultry litter incineration with bhsl, a company ready for commercial production of on-farm small and large scale combustion units. During the trip, project leaders met with bhsl, engineers, poultry producers in England and Ireland, and other research faculty at the University of Limerick to begin the collaboration needed to develop a worldwide market for PL byproducts being generated on a commercial scale. Specifically, bhsl highlights a need to create an outlet for their customers that will dispose of nutrient rich byproducts generated by their incinerators and also to create an income source to alleviate some of the costs of the biomass energy generation facilities. Researcher Dr. J.J. Leahy from the University of Limerick has studied the different elemental changes that occur to P during gasification. Our new question is whether these P transformations can be controlled in order to develop a more consistent P availability from the byproducts. We have collected ash from the commercial bhsl unit in Ireland to continue testing and the first bhsl unit is set to be installed in Virginia at the end of 2012/early 2013.

GOAL 2: Assess whether a predictable P fertilizer product with predictable nutrient analysis can be achieved with byproducts to support tomato production and replace inorganic fertilizer sources imported into the watershed.

Nutrient analysis of byproducts and competitive fertilizer sources are presented in Tables 1 and 2 for 2011 and 2012, respectively. Overall, all sources contain appreciable amounts of P that would be beneficial as a fertilizer source. However, products with higher P concentrations, such as Ash1 and Ash2, would be more beneficial for solving the overall watershed P mass balance issue. Each year, consistent products for testing were produced.

Overall, tomato yield varied by year and will be discussed separately. In no case was the P source × P rate interaction significant; therefore, all data will be presented as main effects and averaged over the other effect. For marketable yield in 2011, TSP (40785 lbs. fruit/acre) yielded higher than Ash1, Ash2, and the no-fertilizer control plot (30153, 34558, and 26082 lbs. fruit/acre, respectively; $LSD_{0.10}$ = 6206 lbs. fruit/acre) (Table 3). Total yield followed the same general trend as marketable yield (Table 4). However, the total yield for Ash1 was significantly the same as applying no-fertilizer at all (Table 4). Marketable yield in 2012 was not significant. Total yield for 2012 indicated that PL yielded higher than Ash2 and no-fertilizer (Table 4). The Ash1 and Ash2 byproducts yielding lower than fresh PL and TSP indicate that not all P is readily available for plant uptake within a growing season. Using these yields and TSP as the baseline for fertilizer availability and price, relative yields are presented in Table 5. Overall, relative yields indicated that no-fertilizer (80%) was the least yielding and followed by Ash1, Ash2, biochar, PL, and TSP (88, 91, 98, 98, and 100%, respectively). Using the two year TSP retail value average of \$0.71 per lb. P_2O_5 (USDA-Economic Research Service), products in the raw byproduct form without consideration for any other beneficial nutrient range from \$0.63 to \$0.69 per lb. P_2O_5 (Table 5). Overall, PL byproducts do form a suitable fertilizer source for fresh market tomatoes, although an availability factor (% of total P that is released within the growing season) needs to be incorporated.

Tomato fruit size was significant for the large size in 2011 and 2012 (Table 6), averaged across P rates. In 2011, the control and Ash1 fertilizer sources were similar with all other fertilizer sources producing more large sized fruit. In 2012, all fertilizer sources were smaller than the no fertilizer P control. The ideal fruit size is large and extra-large as these fruits are sold as whole products in the market place and bring the highest price. Other size averages are presented in Table 7.

Total and marketable yields had significant linear plateau models in 2011 and 2012 and parameters are presented in Table 8. The linear portion of the model with a positive slope indicates a positive response to P fertilizer rates, averaged across P sources, even though soil had very high soil test phosphorus. The slope represents the pounds of fruit produced per acre with each additional pound of P_2O_5 fertilizer. The plateau portion of the model indicated no response to fertilizer application and demonstrated highest yields that can be expected for that season's growing conditions. The joint where these two lines meet indicated the optimal P fertilizer rate necessary for optimal yields. The y-intercept is yield when no P fertilizer was applied. In 2011, marketable yields peaked at 43 lbs. P_2O_5/acre and total yields at 38 lbs. P_2O_5/acre (Fig. 2; Table 8). In 2012, 94 and 86 lbs. P_2O_5/acre were necessary for optimal yields for marketable and total yields, respectively (Fig. 3; Table 8). With fresh market tomato values of \$0.47/pound in 2011, each additional pound of fruit produced (using the slope value of the positive linear correlation) indicated that additional P fertilizer would pay for itself. In 2011 for instance, each pound of P_2O_5/acre produced 249 pounds of marketable fruit. Fertilizer response was smaller in 2012;

however, an additional 94 lbs. P_2O_5/acre cost an average of \$0.68 lbs./P_2O_5 = \$63.92 (Table 5) and produced an additional 4700 lbs. fruit/acre = \$2209/acre. Therefore, additions of P fertilizer are agronomically and economically beneficial to this shallow rooted vegetable crop with payoff benefits far exceeding the usual soil testing threshold.

Data from research projects and from information exchange with fertilizer industry were presented to farmers, agency personnel, and other stakeholders throughout the granting period. Attendance at the Annual Eastern Shore Ag Conference and Trade Show reached over 200 farmers and industry leaders in 2011 and 2012.In 2012, a Poultry Management section was added to the Annual Eastern Shore Ag Conference and Trade Show. As part of the section, Dr. Reiter and Ms. Corson-Lassiter presented data related to this project and also a general overview for litter to energy projects being constructed around the Chesapeake Bay watershed. Also, each year approximately 125 farmers attended the Virginia Tech Eastern Shore AREC Summer field day. During field days, attendees viewed the project and listened while Dr. Reiter and Ms. Corson-Lassiter discussed the ways and benefits of recycling poultry litter byproducts as a fertilizer source. Information was also shared with professionals at the Environment Virginia Symposium (~100 attendees) in Lexington, VA in a special Manure to Energy Workshop and to the Manure to Energy Steering Committee in Washington, D.C. (~30 attendees) that was attended by lobbyists, agency personnel, and non-profit organizations. To date, information concerning the use of poultry litter byproducts as a potential fertilizer has reached over 500 professionals.

Tables and Figures:

Table 1. Nutrient concentrations of phosphorus fertilizer sources derived from poultry litter reported on a "dry basis" for 2011.

Parameter	Unit	Poultry Litter	Ash2	Ash1	Biochar
Solids	%	71.0	98.3	99.4	63.1
Nitrogen	%	4.660	0.068	0.259	0.722
Ammonical-N	%	0.953	0.020	0.007	0.004
Phosphorus	%	1.57	10.30	7.94	4.38
Potassium	%	1.95	18.20	11.40	2.04
Sulfur	%	1.00	3.54	2.78	0.36
Magnesium	%	0.80	5.19	3.91	1.09
Calcium	%	2.33	10.50	15.90	7.51
Sodium	ppm	7630	29200	33700	13000
Iron	ppm	1760	9310	9870	3850
Aluminum	ppm	580	2640	9260	2110
Manganese	ppm	559	4340	3220	674
Copper	ppm	248	907	1250	236
Zinc	ppm	452.0	3180.0	3060.0	31.7
Boron	ppm	57.2	294.0	284.0	38.0

Table 2. Nutrient concentrations of phosphorus fertilizer sources derived from poultry litter reported on a "dry basis" for 2012.

Parameter	Unit	Poultry Litter	Ash2	Ash1	Biochar
Solids	%	68.8	98.4	98.1	56.6
Nitrogen	%	3.71	0.26	0.248	0.392
Ammonical-N	%	0.978	0.016	0.065	0.007
Phosphorus	%	0.87	8.49	9.31	4.61
Potassium	%	2.13	12.1	11.7	4.16
Sulfur	%	0.81	3.02	2.65	0.74
Magnesium	%	0.63	4.08	4.15	0.98
Calcium	%	1.64	13.6	15.3	7.17
Sodium	ppm	5810	35500	25800	18000
Iron	ppm	977	10500	8560	2790
Aluminum	ppm	1570	9760	9310	2300
Manganese	ppm	406	3270	2770	548
Copper	ppm	281	1350	1070	203
Zinc	ppm	641	2900	2570	26
Boron	ppm	37.2	275	304	32.3

Table 3. Marketable yield for fresh market tomato in 2011 and 2012 grown using raised bed polyethylene mulch systems on a Bojac sandy loam in eastern Virginia, averaged across P rates.

		Year	
Phosphorus Source	Product Method	2011	2012
		----------lbs/A----------	
Control†	None	26082 d‡	50973 a‡
Ash1	Combustion	30153 cd	53182 a
Ash2	Combustion	34558 bc	50915 a
Biochar	Gasification	39220 ab	53278 a
PL	Fresh Poultry Litter	37706 ab	55164 a
TSP	Commercial Fertilizer	40785 a	54216 a
$LSD_{0.10}$		6206	4543

†No phosphorus fertilizer applied.

‡Means followed by different letters within each column are significantly different at *p*=0.10 and were separated using Fisher's protected least significant difference tests.

Table 4. Total yield for fresh market tomato in 2011 and 2012 grown using raised bed polyethylene mulch systems on a Bojac sandy loam in eastern Virginia, averaged across P rates.

		Year	
Phosphorus Source	Product Method	2011	2012
		----------lbs/A----------	
Control†	None	37274 c	61323 b
Ash1	Combustion	43583 bc	64277 ab
Ash2	Combustion	48770 ab	61762 b
Biochar	Gasification	54706 a	64394 ab
PL	Fresh Poultry Litter	51080 ab	67583 a
TSP	Commercial Fertilizer	55676 a	65298 ab
$LSD_{0.10}$		7820	4765

†No phosphorus fertilizer applied.

‡Means followed by different letters within each column are significantly different at *p*=0.10 and were separated using Fisher's protected least significant difference tests.

Table 5. Fertilizer efficiency expressed as a function of commercially available triple super phosphate, averaged across P rates.

		Year			Value†	
P Source	Product Method	2011	2012	Average	Wholesale	Retail
		---lbs/A---		---%---	----$/lb. P_2O_5----	
Control‡	None	67	94	80	---	---
Ash1	Combustion	78	98	88	0.48	0.63
Ash2	Combustion	88	95	91	0.50	0.65
Biochar	Gasification	98	99	98	0.53	0.70
PL	Fresh Poultry Litter	92	103	98	0.53	0.69
TSP	Commercial Fertilizer	100	100	100	0.54	0.71

†Based solely on P fertilizer value. Does not take into account processing costs or other nutritional components.

‡No phosphorus fertilizer applied.

Table 6. Large grade fruit yield for fresh market tomato in 2011 and 2012 grown using raised bed polyethylene mulch systems on a Bojac sandy loam in eastern Virginia, averaged across P rates.

		Year	
Phosphorus Source	Product Method	2011	2012
		----------lbs/A----------	
Control†	None	10836 b	14536 a
Ash1	Combustion	11541 b	11723 b
Ash2	Combustion	14804 a	10914 b
Biochar	Gasification	15998 a	11261 b
PL	Fresh Poultry Litter	15135 a	12015 b
TSP	Commercial Fertilizer	16811 a	11636 b
$LSD_{0.10}$		3144	1592

†No phosphorus fertilizer applied.

‡Means followed by different letters within each column are significantly different at *p*=0.10 and were separated using Fisher's protected least significant difference tests.

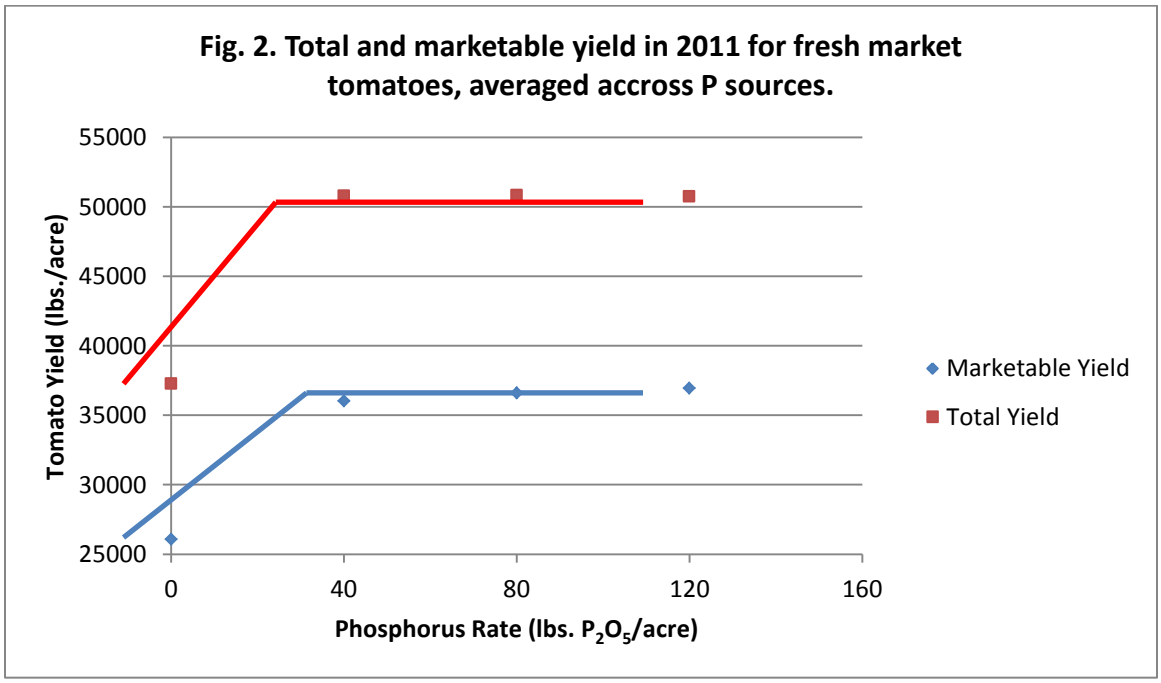
Table 7. Treatment averages for fresh market tomato fruit size distribution, size, and percentage cull in 2011 and 2012, averaged across P rates.

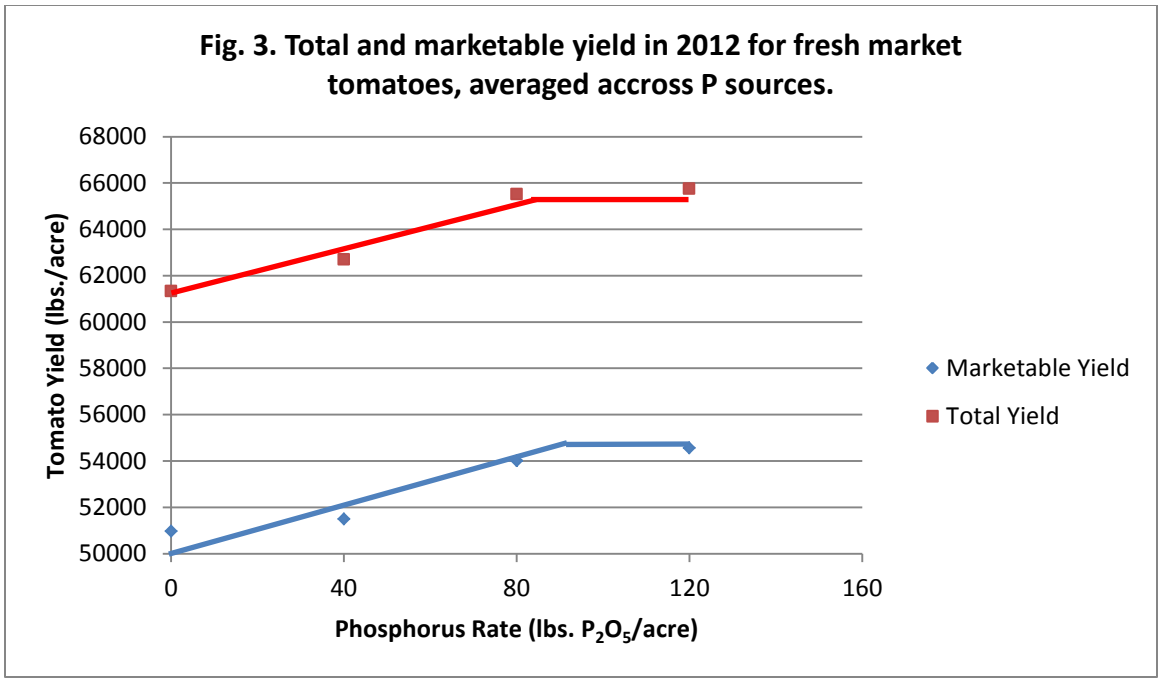
		Year	
Parameter	Unit	2011	2012
Medium	lbs. fruit/acre	8023	3052
Large	lbs. fruit/acre	14859	11510
Extra Large	lbs. fruit/acre	13635	38789
Size	grams/fruit	156.9	198.5
Cull	% cull, total yield as base	28.5	17.6

Table 8. Regression parameters for fresh market tomatoes grown using polyethylene mulch on Bojac sandy loam soils, averaged across P sources. Graphical representation in Figs. 1 and 2.

		2011		2012	
Parameter	Unit	Marketable	Total	Marketable	Total
Plateau	lbs/acre	36772	50797	54553	65747
Y-Intercept	lbs/acre	26082	37274	49825	60491
Slope	lbs fruit/lb P_2O_5	249	355	50	61
P-Rate Joint	lbs. P_2O_5/acre	43	38	94	86

Figure 1.Spreading of poultry litter byproducts. Notice the amount of dust and drift even though virtually no wind was blowing.





4) Beneficiaries

Beneficiaries of this project include fresh market vegetable producers, poultry producers, fertilizer companies, and gasification and energy companies. Overall PL byproducts form a suitable fertilizer source for fresh market tomatoes and can potentially lower the overall cost of P fertilizer to producers. As environmental concerns increase in the sensitive Chesapeake Bay watershed, potential use of PL byproducts on lands that are currently not-available for poultry litter applications or even transportation of nutrients out of the watershed will decrease the burden of PL disposal on poultry producers willing to invest in manure to energy resources.

Additionally, there is a need to manufacture a safe nutrient consistent byproduct. A local Virginia private fertilizer company has expressed interest in assisting with various granulation and pelletization procedures. This company has been a participant in another successful project application to National Fish and Wildlife Foundation for $180,000 to focus on furthering ash research. And finally, project partners have benefited from increased awareness for use of PL byproducts. This project was used to successfully leverage interests for a USDA-NRCS-CIG proposal for bringing manure to energy projects to Virginia. Specifically, $20,000 of the new USDA-NRCS-CIG grant was set-aside to further byproduct research from different energy systems. Total grant costs are $750,000 with total project costs across the Chesapeake Bay watershed equal to approximately $2 million.

5) Lessons Learned

- Overall, PL byproducts do form a suitable fertilizer source for fresh market tomatoes, although an availability factor (% of total P that is released within the growing season) needs to be incorporated.

- Poultry litter byproducts must be reformulated to ensure a safe and consistent application. Small plot work conducted at the Virginia Tech Eastern Shore AREC was implemented on a day with no wind, buckets were held close/touching the ground, and significant byproduct dust was still blowing (Fig. 1).

- There is need for a collaborative effort among industries (poultry, fertilizer and agriculture) to create a successful consistent poultry litter byproduct that can be used readily by local farmers and producers.

6) Additional Information

- VT Fact Sheet with yield submitted for peer review inFall 2012.
- VT Fact Sheet with soil and tissue analysis will be submitted for peer review in Winter 2013.

Sara Reiter
Projects Director
Eastern Shore Resource Conservation & Development Council
PO Box 442, Melfa, VA 23410
757-710-7266
esrcd.sara@gmail.com

Developing, Teaching and Promoting Sustainable and Organic Growing Practices at Maple Hill Educational Farm

Marisa Vrooman
434-286-2176
marisa@localfoodhub.org

I. Project Summary

In 2010, Local Food Hub was awarded a Specialty Crop Grant to fund the project *Developing, Teaching and Promoting Sustainable and Organic Growing Practices at Maple Hill Educational Farm*. During this grant period, Local Food Hub has trained established, beginning, and aspiring farmers in the skills required to produce specialty crops using organic and sustainable methods. Local Food Hub is a nonprofit organization working to strengthen and secure the future of a healthy regional food supply by providing small farmers with concrete services that support their economic vitality and promote stewardship of the land. We work closely with more than 70 family farms in Central Virginia to develop market opportunities for specialty crop products and provide education and support services that promote sustainable and organic growing methods. We designed this project in response to a severe lack of affordable, accessible training available to Specialty Crop Producers in our state. There are very few comprehensive programs in our region that teach the vocational skills necessary to grow specialty crops using organic methods. These methods are not only better for the health of our people and our land, but they also provide opportunities for farmers to be more profitable and competitive in the specialty crop marketplace.

In a survey collected, 31 of the 35 farms that we work with expressed interest in further educational opportunities. Ninety percent of responders desired a class on Integrated Pest Management. Sixty percent requested workshops on succession planting and season extension and 50 percent desired workshops on crop rotation and effective organic soil amendment. Fifty percent of our producers are considered low-income households. There is a definite need to provide our area's Specialty Crop Producers with the further education needed become more effective, profitable, and competitive.

II. Project Approach

The overall objective of this project was to provide accessible, comprehensive, hands-on training for established, beginning, and aspiring farmers in organic and sustainable specialty crop production.

To achieve this objective, Local Food Hub has:

- Researched various organic and sustainable growing methods that may help solve problems that are specific to our region;
- Tested various organic and sustainable growing methods including experimental cover cropping methods, trap crops, and various mulching methods;
- Hosted a series of workshops and seminars on these tested and other proven organic and sustainable growing methods, assisting Specialty Crop Producers to make the most profitable and effective use of their land; and

- Offered four full-time and one part-time apprenticeship positions to aspiring Specialty Crop Producers and taught them the necessary skills to operate a successful organic and sustainable Specialty Crop operation.

Strong partnerships have been integral to the success of this project. The following entities have supported this project in the following ways:

- Radical Roots Farm: Farm owners Lee and Dave O'Neill have acted as mentors and guides in developing apprenticeship curriculum and have also participated, along with their own apprentices, in several of our workshops and trainings.
- SCALE Inc.: Anthony Flaccavento, has provided his expertise, training and guidance not only in developing a challenging and engaging workshop curriculum but as a talented instructor for several workshops.
- CRAFT (Collaborative Regional Alliance for Farmer Training): Local Food Hub apprentices were active members of CRAFT and were able to collaborate and share farming techniques with a variety of other specialty crop producers in our region.
- Va. Polytechnic Institute and Va. Cooperative Extension assisted with curriculum development and will benefit from research and findings, through the Beginning Farmers and Ranchers Coalition. A strong relationship with Christy Gabbard of VT Earthworks was formed and continues to provide mutual benefits. LFH staff has also begun regular collaboration with Cathy Kloetzli, VT Extension, to facilitate the transfer of current resources / updates to farmers.
- Nelson County Economic Development Authority helped Local Food Hub reach more participants by increasing public awareness and referring farmers to our network.

III. Goals and Outcomes Achieved

Goal: Train a minimum of 15 farmers in organic growing methods
Accomplishment: More than 45 farmers have attended at least one workshop.
Goal: Train a minimum of four apprentices in organic growing methods
Accomplishment: A total of five apprentices were trained in organic growing methods

One stated goal of this project was to increase the number of specialty crop farmers who utilize certified organic and sustainable growing methods by providing hands-on training for at least 15 farmers per year. By recording attendance at the workshops and distributing evaluation surveys at the end of every class, we were able to measure the number of farmers participating in this training. More than 45 farmers have attended at least one workshop in 2010 and 2011 -- though many have attended two or more -- so it stands to reason that the goals established were accomplished.

Another stated goal was to train at least four apprentices in one year through direct partnership with Radical Roots Farm and Local Food Hub Educational Farm at Maple Hill. In 2011, Local Food Hub hired and trained four full-time farm apprentices, and one part-time senior apprentice, thus exceeding our goals for this year.

Throughout the course of this grant period, Local Food Hub has performed the following activities:

Project Activity Completed	**# of Participants**	**Project Staff/Partners**	**Date**
Workshop #1: Season extension, high tunnel construction, organic soil amendment and cover cropping	15 attendees	Adrianna Vargo (farm manager), Anthony Flaccavento (consultant)	September 2010
Workshop #2: Tractors, tools and implements for use with specialty crop production	10 attendees	Adrianna Vargo (farm manager), Steve Vargo (farm manager)	October 2010
Workshop #3: Farm planning, financial and time management, organic crop selection, and labor management	10 attendees	Adrianna Vargo (farm manager), Anthony Flaccavento (consultant)	November 2010
2010 Partner Producer Survey: Surveyed specialty crop producers in our network to determine desired workshop topics for 2011	35 participants	Adrianna Vargo (farm manager), Local Food Hub staff, and Specialty Crop producers	December 2010 January 2011
Developed curriculum for 2011 workshop series	n/a	Marisa Vroomann (director), Adrianna Vargo (farm manager), Specialty Crop producers	December 2010 - May 2011
Developed and planned organic growing method trials, trap crop trials, mulching trials, seed varietal trials, and season extension trials	n/a	Marisa Vrooman (director), Adrianna Vargo (farm manager)	January 2010
Set dates and plan specifics of 2011 workshop series	n/a	Marisa Vrooman (director), Adrianna Vargo (farm manager)	February – March 2011
Begin 2011 Local Food Hub Apprenticeship Program	Four full-time, one part-time	Marisa Vrooman (director), Adrianna Vargo (farm manager)	March 2011
Conducted organic growing method trials, trap crop trials, mulching	n/a	Adrianna Vargo (farm manager), Steve	March 2011

trials, seed varietal trials, and season extension trials.		Vargo (farm manager), apprentices	
Workshop #4: Small Plot INtensive (SPIN) workshop, including organic and specialty crop cultivation, crop selection, creative use of land, succession planting and crop rotation	30 Attendees	Adrianna Vargo (farm manager), Linda Borghi (consultant, registered SPIN Farm instructor)	March 2011
Continued to record, manage, and interpret data on organic growing method trials, trap crop trials, mulching trials, seed varietal trials, and season extension trials.	n/a	Adrianna Vargo (farm manager), Steve Vargo (farm manager), Local Food Hub apprentices	April 2011 – August 2011
Workshop #5: Organic Fruit Production, including basic skills, pruning strategies, rooting and grafting, converting ornamentals to fruit producers	30 Attendees	Adrianna Vargo (farm manager), Bill Whipple (consultant, organic fruit grower from West Virginia)	April 201
Workshop #6: Integrated Pest Management, sustainable and organic cover cropping and methods to utilize and minimize insects, diseases and weeds	31 Attendees	Adrianna Vargo (farm manager), Anthony Flaccavento (consultant), Cathy Kloetzli (Va. Cooperative Extension)	July 2011
Workshop #7: Season Extension, high tunnel construction, organic soil amendment, and cover cropping	25 Attendees	Adrianna Vargo (farm manager), Paul and Allison Wiediger (consultants)	October 2011
Hosted conference with partners to discuss findings	50 Attendees	LFH staff and partner producers	January 2012

At the conclusion of each workshop, attendees were asked to fill out an optional anonymous survey rating their general experience in the class, knowledge level of the instructor, and usefulness of the information provided. These were rated on a scale of 1 to 5, with 1 being poor and 5 being excellent. Participants were also asked to share their comments and thoughts on what they did and did not like, what they would like to see more of, and which parts of the class they found most useful.

The majority of participants in all classes rated the quality of information presented both by the instructor and in the handouts and materials as 4 or 5 (with 5 being excellent). Most also rated the duration of the class as 4 or 5 (with some occasionally requesting that the workshops be even longer than their average of 2-3 hours!). In general, participants stated that the classes met or exceeded expectations, though they occasionally asked that there be more interaction between the instructor and the class.

Survey respondents found visual aids (like power point presentations and photographs) and group discussions very important and often the most valuable part of the class. They often requested even more take-home materials and handouts (like pest ID guides), as well as additional networking time.

The biggest complaint we received was about the classroom setting, generally because the barn classroom is not temperature controlled and can be hot in the summer months. We have addressed this issue by hosting summer workshops in the air-conditioned office space on the farm.

Attendees were also asked to share personal thoughts and anecdotal comments about their experiences. These included:

Which part of the workshop did you find most appealing/helpful:
"Each section was useful, but especially appreciated hands-on practice!"
"Not only the engaging speaker, but meeting and talking with other participants. Lots of knowledge exchanged"
"Everything… a lot of light was shed on things that will play a large roll in the development of my farming philosophy"

General comments:
"Very informative workshop. It was cool to hear that this type of thing is manageable and learnable. Linda was a great, down to earth speaker."
"Terrific! Well worth the 3 hour drive!"
"Great workshop! Thanks for the local snacks, too!"
"Thank you for being practical and accessible in your approach"
"Presenter was so knowledgeable, professional, concise, and made excellent use of the time. I appreciated that he is in Virginia."

Finally, we asked attendees to suggest topics for future workshops. These suggestions, taken over the course of the year, have helpful in guiding our speaker and topic choices for future workshops. The most often requested topics included:

- permaculture
- cover cropping
- small engine repair
- beekeeping
- mushrooms
- livestock

- food preservation
- grant writing / financial assistance

The survey results from the workshops have been extremely valuable as we continue to develop and refine our educational offerings. We are now entering our fourth year of workshop series, and we continue to survey participants after every class because the feedback is so useful. We have utilized the survey results in the following ways:

- We have hosted workshops covering 5 of the top 8 requested topics and continue to use these suggestions for future classes.
- Each workshop now includes handouts and visual props/presentations, and often will have take-home booklets or discs.
- We have developed an online Resource Library hosted on our website to provide workshop attendees (and our partner producers) with additional information after the class: http://localfoodhub.org/resource-library/
- We have worked to make the setting of the workshops more hospitable during the hot or cold months by hosting them in our farm office or in a classroom in Charlottesville. We've also begun to host workshops on other farms in the region.
- We always ensure that if at all possible, workshops include a hands-on portion, as well as plenty of time at the end for Q&A and networking.

IV. Beneficiaries

Developing, Teaching and Promoting Sustainable and Organic Growing Practices at Maple Hill Educational Farm benefited beginning, established, and aspiring specialty crop farmers in our region by providing them with free or low-cost educational resources to encourage sustainable and organic agriculture techniques. These skills have made them more competitive in the specialty crop marketplace and increased farm income. Local Food Hub currently partners directly with more than 70 small farms in central Virginia, and networks with many more.
Tens of thousands of Virginians also benefited from this project through increased wholesale and institutional access to healthy, safe local food grown on Virginia farms.
Finally, educational institutions, nonprofit organizations, and government entities have benefited from Local Food Hub's curriculum development, on-the-ground training, and direct farmer relationships through information sharing, educational opportunities, and increased access to farmers.

V. Lessons Learned

Throughout the grant period, Local Food Hub has learned several helpful lessons for developing and implementing a successful workshop curriculum. These include:

- Timing: Workshops have better producer attendance and participation when they are scheduled during the off-season. This makes sense, but requires some adjustment, as it is often helpful to hold classes like Pest Management in the height of the growing season. By adjusting the timing, class length, and scheduling of the classes, we have seen better participation by growers and community members.

- Class Evaluations: We have found it useful to conduct class evaluations at the end of each workshop (rather than at the end of the year). By asking participants to fill out a short survey at the end of each class, we are able to capture real-time data and opinions about the instructor, class content, and other anecdotal comments. The data gathered from these surveys helps us adjust our curriculum and provide feedback for instructors.

We have already put these lessons to work in our 2012 workshop series.

VI. Additional Information

Above: SPIN Workshop attendees learn about organic production in a high tunnel.

Above: Instructor Linda Borghi shows the methods behind small plot intensive farming.

Above: Bill Whipple demonstrates fruit tree pruning methods.

Above: Workshop students enjoy classroom instruction before a hands-on field component.

Above: 2011 Apprentices harvest organic spring mix at Local Food Hub's Educational Farm.

Organic Management of Pest Predation in Commercial Production of Summer Squash

Kevin Damian
804-550-2109
kdamian877@gmail.com

I. Project Summary

The purpose of this project, awarded to the Virginia Association for Biological Farming, was to explore several organic management practices for control of the most problematic pests for summer squash, the squash bug, squash vine borer and the cucumber beetle. As a result of exploring the effectiveness of several organic practices it was hoped that organic and sustainable growers in Virginia would be encouraged to grow more summer squash to meet the growing demand from consumers for this nutritious and flavorful crop. This project was in response to the need for growers to gain more information on viable organic practices for managing pest predation in summer squash.

II. Project Approach

Field demonstrations were established at six farms over the springs and summers of 2011 and 2012. There were six participating farmers for this project, two in the Valley (Hans Burkholder at Glen Eco Farm near Harrisonburg and Mitch Wapner at Paradox Farm near Lexington), two in the Central area (Andy Hankins at VSU's Randolph Farm the first year and at the ACE Garden Project in Henrico County the second year, and Earrett Parson near Elberon in Surry County), and two in Tidewater (Lee Bristow at Dayspring Farm near Cologne in King and Queen County and John Wilson at New Earth Farm in Virginia Beach). In each pair the first year one farm was a test farm and the other acted as a control. The second year each farm switched to being either a test or control farm. This made it possible for all farms to demonstrate both trials. All six farms grew the same four varieties of summer squash, Zephyr yellow, Sunburst patty pan, Raven zucchini and Magda, a specialty mid-Eastern variety. All farms planted equal amounts of the varieties on 1/4 acre plots. The three test farms planted Blue Hubbard winter squash as a trap crop for the pest predators. To test the effectiveness of the trap crop, farmers monitored pest pressure on the cash crop as well as the trap crop, and sprayed the organic pesticide Pyganic on the trap crop. The test farmers did not spray the cash crop. The control farmers without the trap crop could spray Pyganic on the cash crop. The intent of this experiment was to assess how effective a trap crop of Blue Hubbards can be to reduce pest pressure on the cash crop and reduce the use of pesticide.

Beneficial farmscapes of black oilseed sunflowers and buckwheat were planted at all six farms on the perimeter of the plots. Buckwheat was also planted down the center of each plot. The intent of this management practice was to attract beneficial insects that help control the pest populations in the cash crop.

All farmers were asked to keep track of yields to assess differences in the varieties and responses to the management practices. We also wanted to assess whether some varieties were more resistant than others to pest pressure.

All farmers direct seeded their crops beginning in mid-May. The first year most farmers planted their entire crop at one time. The second year five of the farmers staggered the planting over three times.

At most locations both years, farmers reported pest pressure to be relatively light until the end of season when the squash bugs became more numerous. Crop loss ranged from 5% to 20%. All of the farms reported favorable results from the use of the farmscaping, seeing many beneficial insects on the buckwheat and sunflowers, and observing many on the cash crops. Beneficial insects observed included lady bugs, syrphid flies, predatory wasps, lacewings and assassin bugs. Several reported more benefit from the buckwheat than the sunflower, and this could have been in part because the buckwheat matured and bloomed earlier. The test farms all saw significant numbers of the beneficial insects on the trap crop of Blue Hubbards. Overall, the farmscaping showed good potential as a management practice.

For both years the test farms reported significant pest pressure on the Blue Hubbard trap crop prior to the emergence of pests on the crop. The early attraction of the pests to the trap crop perhaps slowed their progression to the crop, especially for the earlier plantings. This was clearest with the populations of squash bugs and cucumber beetles, but much less so with the squash vine borers. The farmers who sprayed Pyganic frequently on the trap crop for the predators observed this was helpful in controlling the pests on the crop.

When the farmers on the control fields sprayed with Pyganic on the cash crop they observed better effectiveness of the pesticide on the squash bugs than the cucumber beetles. Pyganic seemed to have little effectiveness on the squash vine borers.

Yields measured over the two years varied between 1717 and 4200 pounds for each farm. The yield measured by pound was hard to compare between farms because the farmers harvested at different stages of growth. At Glen Eco Farm the Zephyrs were harvested at the immature stage with the blossoms still attached. This lowered their total yield by weight, but greatly increased their appeal to a specialty market.

The yields of each variety of summer squash did show some striking differences. The Zephyr significantly outyielded the others both years even though one farm harvested most of these at an immature stage. The Raven zucchini was the second best yielder. The Sunburst patty pan was third in total yield. The Magda variety yielded the least, but reportedly had an excellent flavor.

It was difficult for most of the farmers to assess how the varieties differed in their resistance and vulnerability to the pest insects. Generally the zucchini varieties, Raven and Magda, were more vulnerable and the Zephyrs were most resistant.

Soil tests were conducted at all the farms by Dr. Mark Schonbeck and he provided thorough interpretations and recommendations for amendments. Dr. Schonbeck's participation was very helpful to the farmers and very likely contributed to the strong yields all farmers reported.

Drip irrigation supplies were provided for all the farmers and these were especially helpful to the farms in the Valley and Central areas where dry conditions were more pronounced both years.

All farms over the two years hosted field events for farmers, agricultural educators and consumers. While most of the growers who attended were already using sustainable practices, many were unfamiliar with farmscaping and trap crops and were not growing all the varieties of squash in this project. Many of the participants at the field events were interested in receiving more information from the final outcome of this project and expressed interest in growing more summer squash. The total number of participants over the two years was over 350, demonstrating a strong interest in this project.

Most of the participating farmers presented at a workshop session at the 2013 Virginia Biological Farming Conference where they shared their experiences and observations from the summer squash project. The session also included input from the project coordinator, Charlie Maloney, and the soil consultant Mark Schonbeck. An excellent information document was made available to the conference workshop attendees that included a summary of the results of this project. There were about 100 attendees at this workshop. Additional copies of the document have been made for future distribution to growers thus expanding the potential outreach of this project.

III. Goals and Outcomes Achieved

All six farms participated fully in the project over the two years, successfully planting according to the work plan and implementing the organic pest management practices. The average yield for all farms was 3000 lbs per 1/4 acre field. While it is not known how many of the 350 growers who attended the field days established production on their own, if 100 of them began commercial production on this scale, the economic benefit would be $112,500.

All six farms hosted field events over the two years, an activity which reached many more growers interested in organic commercial production of summer squash. At all these field events, participants learned about organic pest management, insect identification, appropriate harvest and post-harvest handling, additional squash varieties, drip irrigation, and marketing. At several events, the farmers demonstrated cooking of summer squash and provided samples to the participants, providing information to the growers that they could use at their own markets.

The goal to present a workshop at the Virginia Biological Conference at the completion of the project was accomplished. The farmers, coordinator and consultant presented the workshop to over 100 attendees, with engaging feedback and interest. A very comprehensive and detailed information sheet was developed, as planned in this project, and distributed to all present at the workshop. Additional copies of this document have been printed and will be available to interested farmers and groups in the future. This will help insure that the outcomes of this project will continue to be communicated to other growers.

In early spring of 2014, a survey will be mailed to the VABF membership to ascertain (1) what farmers established summer squash as a new agricultural enterprise and (2) who earned at least $1000 of net income from profitable sales of summer squash. We anticipate having final results by March 31, 2014.

IV. Beneficiaries
Groups and other operations that gained benefits from this organic summer squash project were:

Over 350 growers, farmers, gardeners and educators attending the six field events hosted by the participating farms.
Members of the Virginia Association for Biological Farming.
Over 100 attendees at the workshop presented by the project participants at the 2013 Virginia Biological Farming Conference.

Virginia Cooperative Extension -- Agriculture Extension Agents.

Numerous workers at the participating farms who learned new organic practices for managing pests in summer squash.

V. Lessons Learned
Overall the trials demonstrated that a combination of the organic management practices for pest predation in production of summer squash was effective. It was difficult, however, to assess which of the practices was more helpful. Clearly the interplanting of buckwheat and sunflowers with the squash introduced many beneficial insects, and some of these insects helped control the pests on the crop. Also, the trap crop of Blue Hubbard Winter Squash did consistently draw many of the problematic pests earlier than the crop providing some control. The trials demonstrated that combining these practices could reduce the necessity for spraying Pyganic or any other organic pesticide, saving the farmer time and expense.

The trials were set up so each farm was either a test or control field each year. This helped simplify the observations and record keeping for the farmers, however, the project might have yielded more useful information if each farm had been set up with both a test and control plot each year. There were too many variables in the research, especially with the control and test farms separated by distance each year.

Summer squash are also very vulnerable to disease pressure as the season progresses. It was difficult for the farmers to assess whether crop loss was due to this disease pressure or to pest predation. More training and information for the farmers to make this assessment would have been helpful.

In the second year farmers were provided with more record-keeping tools for harvest and pest control management. These proved to be very useful and should be recommended for future similar research. Having these tools facilitated more consistent data and increased work efficiency for the farmers.

With regard to measurable outcomes, we found it helpful to establish outcome measures that can be monitored **within** the grant period. Also, it is difficult to get measurable outcomes from farmers other than those who are participating as growers within the grant project.

VI. Additional Information
Charles A. Maloney, Project Coordinator

Dayspring Farm, 942 Buena Vista Rd
Cologne, VA 23181
dayspringfarm@aol.com
804-785-9401

Working Capital Grant to Develop a Broad Based Website for the Promotion of Virginia Apples

Diane Kearns
540-667-3390
didi@shentel.net

1. Project Summary:
   The Apple Board, The Virginia State Horticultural Society and the Virginia Apple Growers submitted a grant proposal to create a new, comprehensive website for the apple industry in Virginia. The new website is VirginiaApples.net also Virginiaapples.org. We were unable to purchase the .com designation. That is already owned by someone in Russia. The decision came as a result of representatives from each of these organizations sharing the same concern that the web presence of the Virginia apple industry was not one that was supportive of the industry as a whole. The site was not current and was not being maintained. The representatives also realized that it was imperative to be proactive in order to be competitive in the new age of social media and electronic information. There are a total of 51 Virginia orchards listed; this comprises all the orchards that are in Virginia to date. There are a total of 37 packers and shippers listed. This new list is a more detailed and accurate listing that was previously available. There are 18 cideries listed on the new website. Almost all have never been represented before. This list differentiates between hard cider (a new and growing industry in Virginia) and sweet cider.

11. Project Approach:
    The representatives of the sponsoring organizations determined that the project would require a coordinator who would take on the project, find a web-designer and oversee the project following the guidelines set forth by the representatives.

    The project began when the coordinator, Tootie Rinker, joined the project. Several meetings were held with the coordinator and representatives to determine what content was needed for the website. Each person had input into the process. The website was to contain the following:
    - A comprehensive listing of apple orchards and industry located in Virginia.
    - An interactive map where orchards were located.
    - A listing of apples grown in Virginia.
    - A section that would pertain to members of the various organizations where lists of meetings, minutes, notices and other pertinent information would be posted.
    - Links to supportive industry and all orchards listed that had a website.

111. Goals and Outcomes Achieved:

The first goal was to put out bids for the website design. A bid package was created which outlined the project and listed the required content. A budget was also included in the package along a time line with a due date. The coordinator called each company to ascertain their interest in the project. Six companies expressed an interest in bidding on the project. At the time of the set due date three of the companies submitted project designs. The representatives met and reviewed the packages on two different occasions. Orange Pippin was selected as the web designer on the basis of their proposal. They also offered a connection to their international website which is a comprehensive listing of apples.

The second goal was to create the content for the new website. Some information was taken from the then current website. Other information was obtained from research into the Virginia apple industry through publications by growers and interviews. The result is a great deal of information about the apples in Virginia. This allows the site to be refreshed on a regular basis, keeping it vibrant and a site that consumers will return to view frequently.

Several growers were interviewed to create the list of apples grown in Virginia. The apples that are listed are varieties that are readily available in Virginia; it is not a comprehensive listing of all apples grown. Since this is a website where one of the consumer groups is the general public, it was decided by the organizations to list only those apples readily available to the public in Virginia. The partnership with Orange Pippin gives the Virginia website the ability to add new varieties with their information as they are added to the international Orange Pippin website. The design also gives pictorial information about apples. It was reported that consumers have gone to orchards to purchase apples with copies of this page in their hands so they can "find" a certain apple.

The orchard listing was the next goal. The coordinator, along with assistance from the Director of the Virginia Horticultural Society, contacted the growers in Virginia to confirm their contact information as well as links to their sites. This was done through the Virginia Fruit magazine. Phone calls were made to those who did not respond. There is now a comprehensive listing of Virginia orchards on the site. They are listed by county, by direction (number of miles from a particular site), and by name.

The apple industry was a challenge. It has changed significantly in the last few years. Calls were made to several Virginia companies to check information for accuracy and updates. It was determined that two companies would not be included. Virginia growers sell to these companies, however; they do not have a presence in Virginia. The listing is now updated and some new facilities are listed.

One very specific goal of the project was to enable individual growers and industry members to add their programs and events to the website themselves.

The entries are monitored to insure appropriate content but this feature helps the make the information timely and more accurate.

The member section was created and information was sought from the Horticultural Society, The A.H. Smith Fruit Research Station, and Cooperative Extension Service. It was envisioned that this section could be made to be a "password only" section; however this may not be possible because of cost. However, we are pursuing this feature for the future.

Another goal was to enable the site to be translated into other languages, especially Spanish. The original idea was to use Google Translate but this has been taken off the internet because it was not as accurate as planned. Orange Pippin is looking into translating with another method at this time. They are also faced with this challenge even between their British and European consumers.

A new industry was included, the apple cider makers. There is a comprehensive listing for cider makers. Sellers of sweet cider, producers of sweet cider and of hard cider are listed and delineated by an icon. Their information is also listed with links to their websites if they exist. The hard cider industry is new and including them benefits the Virginia Apples website helping to meet our goal of being the most comprehensive source of apples in Virginia. It will enable the cideries to promote their programs and products to the public as well as to the apple growers.

Yes, we now have 100% of the Growers who are members of the Virginia State Horticultural Society on the current website. In addition we have been able to add packers and shippers who were not on the website prior to this.

Unfortunately, The VA Apple Growers Association does not have contact with the previous website host and has been unable to ascertain the previous website hits. We will continue to search out this information. The apple website management traded hands just prior to this project.

Quantifying is difficult because there are Growers who do not use the web at all. However, we were able to add a whole new industry, the Hard Cider Makers, and able to separate those who do only sweet cider from the hard cider. We plan to use this new partnership to educate the public about the new industry as well as the sweet cider. We did contact each member by mail or phone to make sure their listing was correct. We were able to encourage them to list on our website even if they did not have a web presence of their own.

IV Beneficiaries:

The beneficiaries of the Virginia Apple website include not only the apple industry members, growers and producers but also the general public. The site includes recipes and will have an additional tab for the "home orchardist", the homeowner who has a few trees and needs a source of information. The "pick your own" (PYO) facet of the apple industry has grown. Currently there is resurgence of interest in learning where food comes from and seeing where and

how it is grown. This has increased interest in the PYO programs around the state. The interactive portion of the website, showing where orchards are located and information about them will help to support this part of the apple industry. The links to orchards and related businesses should also help not only the consumer but those businesses by giving them additional exposure to members and the general public.

V. Lessons Learned:

The most important lesson is that this website must be maintained on an ongoing basis. Without constant monitoring and change it will become stagnant and instead of supporting the apple industry in Virginia, it will become a detriment.

While growers welcome anything that will help them many also do not want to be directly involved with the internet or social media. The new website and its sister "Facebook" page will give them the advantages of the internet and participatory media without their personal commitment to maintain their own media and social website presence.

Social media is the new way information is sought and obtained in the world today. It is imperative that the industry invests in social media presence on the web in order to be effective in today's economy.

Our partners, Orange Pippin, both the US partner and his British counterpart came to Virginia and toured for a week to see the industry. This gave them a new appreciation for Virginia apples as well as more ideas to improve the Virginia Apples website. A meeting with the representatives of the three partnering organizations who obtained the grant cemented the partnership.

While data was not available to us as to the number of hits that the previous website received, we were able to determine that the present site has averaged 175 hits per month. More importantly we are now able to determine what people are looking for which will help us to tailor our home page to address some of these questions. Top searches were area specific, i.e. "apple orchards in Richmond, VA, honeycrisp apples Harrisonburg, VA, etc. We can also look at specific apple varieties being selected. We have also learned that the site ranks very well in Google. Typing "Apples Virginia" you will see the site in the top of the page, but more importantly typing in specific apples such as "Gingergold" also shows positive results.

We have also learned how important it is for our growers to have access to information regarding their member organizations. The recent annual meeting was listed as well as registration materials. In addition the ability to put their own "events" on the website was important to them.

We are also seeing a number of email requests for purchase of wholesale apples to import/export companies. The ability to refer directly to the website for contact information to has been helpful.

VI. Additional Information:

Maintaining the website is the next goal that has been established by the organizations. Along with Orange Pippin, we are looking at how we can improve the site and met the challenges presented such as a translation method.

Tootie C. Rinker
Virginia Apples
1567 Marlboro Road
Stephens City, VA 22655
VAapples@gmail.com

Connecting Southwest VA Farmers to Institutional Buyers Through Local Food Processing and Preservation

Mike Burton
540-250-0111
Mikeburton7@hotmail.com

I. Project Summary

The 2010 SCBGP grant funded the completion of a feasibility study dated October 31, 2011 (the feasibility study). The first part of the feasibility study focused on a local foods assessment of the region and established a demand for the facility that justified project development. The second part focused on project implementation providing a blueprint for further development by a Lead Project Developer (LPD) supported by SustainFloyd, the Project Steering Committee and other stakeholders.

The study examines the viability and success parameters of a processing center in Floyd County, Virginia. The center aggregates, processes (adding value and preserving) and packages locally grown fruits and vegetables then markets and distributes the product to regional markets including institutions, college cafeterias, Farm-To-School programs, grocery stores and restaurants. The project connects southwest Virginia farmers to these underserved large customer groups actively seeking locally-grown, sustainably-farmed food that meets their unique requirements.

The project analyzes how to provide the necessary link now missing in the value-chain model seen as the ideal in creating a local food system. The facility would not compete with the region's vibrant small-scale farms now serving CSA's, farmers markets and gourmet restaurants. Instead, it would allow existing and new Virginia farmers to serve larger yet less sophisticated consumers who require a larger scale, greater consistency of product, ease of preparation and availability outside the growing season. In addition, research would investigate the marketability of a local brand for the sale of higher-end products to serve niche markets.

II. Project Approach

Activities included but were not limited to: Formation of Community Advisory Board to help inform the study; creation and dissemination of RFP for the consultant; hiring process of consultant; contracting with Smithson Mills, Inc. (SMI) to perform the study; numerous meetings, in person, via phone and Skype between the consultant and the Steering Committee; the consultant visited Floyd two times and met with Carilion Clinic Hospital, US Foods, Virginia Tech Sustainability Coordinator, VT Dining Services and US Foods, Blue Mountain Organics, Good Food Good People (local distributor); preparation of survey of Virginisa's Finest members to measure the need for co-packing services, preparation of survey of regional food entrepreneurs to assess the demand for shared use facility; processing of results from the survey; preparation of interim report; holding of a well-attended community meeting to review the interim report; preparation and dissemination of a summary of the meeting to Community Advisory Board; meeting with facility expert and county government to review possible sites for the facility; meeting with consultant, VDACS inspector and county inspector to review regulatory issues; meeting with VT Food Science Department; preparation of the draft of the final report; reviewing and approving numerous versions of the report leading the a 111 page final.

Once the final report was completed and vetted among our committee, a community meeting was held presenting the plan with Smithson Mills leading the presentation. The plan has been available on the SF website and approximately 35 hard copies have been distributed to interested parties. A copy of the study accompanies this report.

In addition, the workplan called for the identification of farmlands in Floyd County, VA. Blue Ridge Site & Soil, a Floyd-based business, was hired to undertake this analysis. It was quickly discerned that identifying particular farmlands was well beyond the achievable scope and budget. Instead, the consultant developed an approach to be used as the project moves forward incorporating known technologies for assessing proposed grow-sites or searching for suitable land to grow raw product for the facility.

The findings are included in the report entitled, Identifying Prime Farmlands in Floyd County, VA: A GIS and Soils Based Approach. A copy of the report is submitted with this report.

The feasibility phase of this project's development is now complete.

SMI as the lead consultant provided the bulk of the work on a fee for service basis. County Government staff, our local extension agent and Jeff Walker of Blue Ridge Site and Soil have also guided this project with extensive participation. SF staff has been deeply engaged with the consultants and the community to administer the project.

Virginia Department of Agriculture and Community Services (VDACS) also provided support for this project. It's Virginia's Finest initiative surveyed member food producers to gauge the need for contract packaging services in the state. This formed a major aspect of the launch strategy for the facility.

III. Goals and Outcomes Achieved

The feasibility study as contemplated in the grant proposal was successfully completed, providing the basis for the Action Plan and further project development by SustainFloyd. The key findings are summarized as follows:

- Results from the regional food assessment suggest that a level of demand for establishment of a value adding food and agricultural facility may be sufficient to justify project development.
- Research has identified a developing local foods movement in the region that provides market opportunities for manufacture and sale of value-added local foods.
- Opportunities exist for direct-to-consumer sales, wholesale distribution to retailers and restaurants, and direct sales to large institutions.
- Area institutions, including Virginia Tech and smaller private colleges, are actively seeking ways to support local food entrepreneurship and farming, and several have an interest in sourcing value-added food products from a facility processing locally grown products.
- More than 42 small scale food entrepreneurs responded to a survey to document their existing demand for a food processing facility that will enable them to expand and professionalize their businesses. These entrepreneurs require physical infrastructure, including specialized equipment within a facility that is in compliance with local, state

and federal regulations concerning commercial production of food products. They also expressed a strong need for marketing support, business plan development, and technical assistance in product formulation and packaging.

- Eleven existing food businesses in Virginia responded to an email survey indicating demand for contract manufacturing services for their food products that are already in the marketplace.
- Southwestern Virginia, and the state as a whole, has very few co-packing facilities and many small food businesses are now having their food products manufactured out of the state. The responding businesses indicated a strong need for a reliable relationship with a contract manufacturer based on transparency, reasonable pricing, confidentiality, and exact product formulation.
- The research indicates that a value adding food processing facility may be successfully developed using a three-pronged strategy of services. These three services are: 1) providing signature branded processed foods to area institutions and retailers with a defined local label or labels; 2) providing shared-use access of production space, storage, and technical assistance for small scale food entrepreneurs located in the region, and; 3) providing contract manufacturing under private labels for existing value adding food businesses in Virginia.

Phase II research focuses on the infrastructure – physical, legal, and organizational – necessary to build and operate a value-adding facility that reflects measured demand from Phase I findings.

- Project leaders are recommended to consider a site at the newer Floyd Commerce Park, located on the outskirts of the Town of Floyd, as the home of a new value-added food and agricultural processing facility. Attributes that make this site preferable are numerous. The area is currently zoned for commercial activity and includes easy access for tractor trailer trucks. The industrial park is extremely under-utilized, with only one commercial building in operation among multiple lots, all of which are graded and essentially build ready. The park has stubbed-out water and sewer access, as well as a readily available electric supply, including 3-phase power, from a nearby transformer station.
- The researchers recommend construction of a 10,000 square foot facility that can accommodate a wide range of users and types of equipment. The sketch provided in this report includes two manufacturing kitchens, a dehydration and pickling room, walk-in coolers and freezers, loading docks, offices, bathrooms, and open space for staging and dry storage. The cost for base facility construction is calculated on a square footage basis, and is estimated at $1,136,975.
- Equipment needed to fully outfit the facility is listed and discussed and is priced at $693,240 for all new equipment. While prices for new equipment are quoted, the researchers anticipate many pieces will be bought used. Significant cost savings can be realized through used purchases, with an estimated total cost of $425,000 for a combination of new and used equipment.
- Based upon the economic disadvantages of Floyd County and established precedent, SustainFloyd should be able to establish a subsidiary single-member LLC as the management entity for a value-adding food and agricultural processing facility. An operating agreement between SustainFloyd and the subsidiary must be developed that explicitly states the purposes of the subsidiary will conform to the purposes of the parent nonprofit. Advantages of this approach are discussed in detail. If SustainFloyd chooses to

manufacture products with a Floyd-identified label, the researchers recommend establishing a for-profit entity that can be incubated at the facility and which will pay regular use fees similar to any other users. Likewise, a for-profit copacking entity can also be established at the facility.

- This project will best succeed by hiring an executive director with significant food production and culinary experience. This individual should be hired a few months before the facility is open for services. Key duties of this individual will include facility strategic management, daily operations management, billing and bookkeeping, educational outreach, consulting, and technical assistance. The executive director can also serve as production supervisor for businesses housed at the facility manufacturing local-identified signature products and providing co-packing services for existing food businesses in Virginia.
- The base cost of operating this facility is estimated at about $127,000 in the first year, followed by a decrease to about $110,000 in subsequent years. The researchers recommend a goal of approaching or achieving break-even five years from the date of opening. Revenues will be generated from user production fees and storage fees. The anticipated revenue sources are from existing small businesses wishing to access the facility ($60,000 per year), a start-up businesses manufacturing and selling locally-grown value added foods ($30,000) and a start-up business providing contract manufacturing services to existing food businesses ($30,000).
- Researchers recommend SustainFloyd establish a community advisory committee to provide oversight and input during project development. Representation should be given from Floyd County government, Virginia Tech Cooperative Extension, Virginia Tech Food Services, The Floyd County Chamber of Commerce, The Virginia Department of Agriculture & Consumer Services.
- The estimated timeline for project development is three years from the conclusion of the feasibility study. This is contingent upon successful fundraising and securing a necessary site at the Floyd Commerce Park. The estimated total amount of investment required, including facility development and post-opening operational support, ranges from $1.8 million to $2.5 million overan eight-year period.

IV. Beneficiaries

The ultimate beneficiaries of this work will the specialty crop growers in Southwest Virginia and beyond should the facility come into operation. The facility will ultimately source local specialty crops to create a wide range of value-added, regionally branded products created by providing three services. These services are: 1) providing signature branded processed foods to area institutions and retailers with a defined local label or labels; 2) providing shared-use access of production space, storage, and technical assistance for small scale food entrepreneurs located in the region, and; 3) providing contract manufacturing under private labels for existing value adding food businesses in Virginia.

At this start-up phase, we cannot accurately gauge the number of beneficiaries the long term project would impact beyond those responding to the survey. That said, a huge impact is easily perceived when considering the potential effect on farmers, the consuming public and local economies. Experience from similar facilities supports this proposition.

V. Lessons Learned

What we realized rather quickly was that without a real product or history of production, institutions and retailers had difficulty committing to a partnership or making any kind of commitment to purchase. Most were willing to continue discussions and were intrigued by the concept but needed more concrete offerings to enter into real agreements or detailed negotiations. Nonetheless, relationships were formed that will prove invaluable as the project moves forward. Determining an accurate demand for local value-added food may not be possible beyond a general understanding of the desire to support local foods and use them if economically possible until we have actual products on-line.

The emergence of a shared-use kitchen and co-packing void in the food manufacturing sector in Virginia came as a surprise. We would not have anticipated a need for these services without the expertise and research provided by our consultants. This information leads to a much stronger and more diversified income stream for the operation and greater sourcing needs from regional specialty crop growes.

VI. Additional Information

Please see the accompanying documents for complete copies of the funded studies.

Contact: Mike Burton, Director
SustainFloyd
mike@sustainfloyd.org
540-745-7333

Expanding Markets for Virginia's Specialty Crops
Butch Nottingham
Butch.nottingham@vdacs.virginia.gov

I. Project Summary

Canada has been an important market for specialty crops for Virginia companies for over 100 years. Our goal was to work with two Virginia farm operations and several Canadian buyers to increase Canadian Sales green beans and donut peaches. Green beans are a staple in both American and Canadian diets, and donut peaches are a relatively new crop to the East Coast and are not grown in Canada. Since Canada has a robust stone fruit industry and the crop usually overlaps with Virginia peaches we did not anticipate additional sales of peaches and nectarines. However, Loblaw made significant purchases of stone fruit each year so we include them in our sales figures.

II. Project Approach

We employed a variety of activities to achieve our objective including trade show participation, product sampling, grower visits, and buyer tours. VDACS staff and at least one grower attended the Canadian Produce Marketing Association tradeshow from 2010-2013. In 2011 we were able to conduct a product sampling for donut peaches in 50 stores of a major grocery chain Eastern Canada. VDACS staff was able to visit 10 of the stores during the sampling. In 2012 we did a PR campaign with a Canadian PR firm. In 2013 we conducted a farm tour for two of the largest wholesalers in Eastern Canada

III. Goals and Outcomes Achieved

Goal: Increase sales from Virginia farming operations to Canadian Retailers and Wholesalers
Performance Measure: Increase sales of green beans, donut peaches and stone fruit by 5% per year
Benchmark: We set the benchmark by obtaining sales information from the two Virginia growing operations for their 2010 seasons.
2010-Donut peach and stone fruit sales: $93,696 Green bean sales: $431,200 total $524,896 Benchmark
2011-Donut peach and stone fruit sales $266,217 Green bean sales $308,375 total $574,592 Donut peach and stone fruit increase 284% Green bean sales decrease of 28.5% total sales increase 9.45%. In-store sampling drove sales of donut peaches even though Canada was promoting local peaches in all the stores we visited. Children in particular found the fruit appealing, the size and shape makes it easier for a child to eat, and they thought the shape was "neat". Adverse weather conditions, both drought and excess rainfall, impacted bean sales negatively.
2012-Donut peach and stone fruit sales:$193,362 Green bean sales $540,946 total 734,308 Year over year Donut and stone fruit sales decreased by $69,855, but were 106% higher than the benchmark. Green bean sales rebounded due to better weather and were up $232,571 Year over year, and were 25% higher than the benchmark.
2013-Donut peach and stone fruit sales: $25,480 Green bean sales $782,710 total 808,190 Year over year donut and stone fruit sales plummeted by 167,882 or 658%! An early spring and heat wave from Florida to eastern Canada caused much of the fruit on the East Coast to mature at the same time. While the grower was dealing with weather issues, both stone fruit buyers and

category managers changed shortly before the season at the chain store that we used as the benchmark in the project. Unseasonable weather and the buyers' staff changes combined to make 2013 the biggest disappointment in the project with regards to stone fruit. Both the grower and retailer are committed to resolving the issues in 2014, and although the project has ended we intend to work and assist the grower and buyer as they move forward. We had also hoped to do an Asian pear promotion in 2013, but the same factors that impacted the stone fruit situation prevented us from being able to do that promotion as well. Green beans fared much better. 2013 was the best year of the project, with a year over year increase of $241,764 or 44.6%, and 81.5% higher than the benchmark.

Total Sales Increase from 2010 benchmark-We exceeded the benchmark each year of the project, the total increase from 2010 to 2013 was $283,294 or 53.9%.

IV. Beneficiaries

VDACS staff has benefitted by the relationships established and based on this experience, we will be able to assist any Virginia farm operation who has an interest in doing business in Canada. Since we were unable to use the funds allocated for promotions in 2013, we used them to sponsor a farm tour in Aug for two of the largest wholesaled operations in Eastern Canada. One of the participants was a major buyer of green beans from one of the growing operations in our project and had the opportunity to see the bean operation in person. In addition we took the tour participants to a sweet corn and broccoli operation and Virginia's largest watermelon farmer, and our premier spinach operation. While it is too early to assess the effects of the tour, Virginia broccoli has been purchased by one of the firms, and there is potential for large purchases of broccoli, sweet corn and spinach in future.

The project encompassed three distinct approaches (promotion, trade shows, farm tour) and gave Virginia's entire specialty crop grower community an opportunity to expand their distribution channel and take advantage of export opportunities.

Promotion- The donut peach promotion and PR campaign opened a door for the export of Virginia stone fruit into the Toronto market, and will benefit the Virginia stone fruit industry in the future. Based on feedback from the field representative of the major chain in Toronto, Virginia is now established as a supplier of quality stone fruit.

Trade shows- Attendance at the Canadian Produce Marketing Association's largest trade show for the three years of the project also had an impact on many more growers other than the two that we used as measurement of success. Operations that grow potatoes, grape tomatoes, greens, and broccoli were all represented at the trade shows either by growers or Dept of Agriculture staff. Please see attachment with contacts made by staff and growers at the trade show.

Tour- As stated above we used part of the proceeds of the grant to conduct a tour of Virginia's specialty crop farm operations. One of the participants was a major buyer of green beans from one of the growing operations in our project and had the opportunity to see the bean operation in person. In addition we took the tour participants to five Virginia farms where the following specialty crops are grown potatoes, grape and cherry tomatoes, watermelon, sweet corn, broccoli, and spinach. While it is too early to assess the effects of the tour, Virginia broccoli has been

purchased by one of the firms, and there is potential for significant purchases of all of these commodities in the future by one or both of these buying operations. Both the green bean operation and the sweet corn and broccoli operations partner with 15 Virginia growers each, and the watermelon operation partners with five other Virginia watermelon growers, so in at least 40 Virginia specialty crop operations stand to benefit by the tour.

V. Lessons Learned

Be Flexible-There are a lot of moving parts to a fruit and vegetable marketing campaign. Weather, logistics, relationships, quality of product, and scheduling, and unforeseen opportunities all play a role in the success of this type of project. What appeared to be a fairly straightforward project with a substantial travel budget centered on relationship building was adjusted several times. The fact that all the partners were willing to make changes to the project made it a stronger and better project. We now know that the introduction of a niche specialty crop gets more positive impact from a product sampling than a PR campaign, which will make it easier for a producer to use marketing funds more efficiently.

Focus on the farmer-Staff worked with the farmers and included them in any decisions. Over the course of the project we all became good friends as well as co workers. It is about more than the numbers, the relationships formed during this project have the potential to impact all of the operations in the future.

VI. Additional Information

Butch Nottingham
VDACS Regional Market Development Manager
757.787.5876
butch.nottingham@vdacs.virginia.gov

Improved Management of Harlequin Bug in Cole Crops

Thomas Kuhar
tkuhar@vt.edu

PROJECT SUMMARY

Harlequin bug, Murgantia histrionica (Hahn) (Hemiptera: Pentatomidae), is a specialist herbivore of cruciferous vegetables (Brassicaceae) and is an important pest of cole crops (Brassicale: Brassicaceae) in the USA (McPherson & McPherson 2000; Wallingford et al. 2011). The piercing-sucking feeding of adults and nymphs create white blotches on leaves, making vegetables sold as greens unmarketable, and under heavy pest pressure, can kill plants or entire fields of cabbage or broccoli (Paddock 1915; Ludwig & Kok 2001). Although most broad-spectrum insecticides such as organophosphates, carbamates, and pyrethroids provide effective control (Rogers & Howel 1972; Wang 1978; Edelson & Mackey 2005a,b; McLeod 2005; Walgenbach & Schoof 2005; Kuhar & Doughty 2009), these insecticides are also detrimental to important natural enemies in the crucifer crop agroecosystem (Xu et al. 2001, 2004; Hill & Foster 2003; Cordero et al. 2007).

The purpose of this project was to evaluate the efficacy and to help implement the use of soil-applied (or transplant drench) applications of neonicotinoid insecticides as well as the use of trap cropping for harlequin bug management in collards and other cole crops. The specific objectives of this project were three-fold: (1) to evaluate the residual efficacy of various soil-applied neonicotinoid insecticides (imidacloprid, thiamethoxam, dinotefuran, and chlothianidin); 2) identify proper trap crop plant species through lab research/bioassays; and (3) identify proper implementation of the trap crop by evaluating their effectiveness in field/research trials at Virginia Tech research facilities as well as on commercial vegetable farms in Virginia.

II. Project Approach

Objective 1 To evaluate the residual efficacy of various soil-applied neonicotinoid insecticides (imidacloprid, thiamethoxam, dinotefuran, and clothianidin).

Neonicotinoid insecticides offer a less-disruptive alternative for controlling hemipteran insects; they are water soluble and can be taken up by plants through the roots and translocated through the xylem vessels to plant tissues, exposing herbivores to the toxin only when they feed (Sur & Stork 2003; Tomizawa & Casida 2005). Neonicotinoids target the nicotinic acetylcholine receptors in insects, which over-stimulate neurons leading to paralysis and the ultimate failure of the central nervous system (Thomson 2000).

The neonicotinoid insecticides acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid, and thiamethoxam have been found to be effective in controlling harlequin bug when used as a foliar spray (Edelson 2004; Edelson & Mackey 2005c, 2005d; 2006; Walgenbach & Scoof 2011). However, soil application of neonicotinoids could allow for greater residual efficacy against the target pest while reducing non-target effects by not leaving surface residues on foliage as occurs with foliar application. The objectives of this study were to compare and contrast the relative toxicity of 4 neonicotinoid insecticides on the harlequin bug and to assess the residual efficacy of these compounds when applied as a drench to the soil surface in the field.

MATERIALS AND METHODS

Leaf Disk Bioassays to Estimate LC_{50} Values

Dose-mortality was estimated for 4 insecticides; the formulations and registered field rates for vegetables are listed in Table 1.

TABLE 1. INSECTICIDES EVALUATED AND THEIR APPLICATION RATES IN FIELD EXPERIMENTS. RATES USED WERE THE HIGH END OF THE REGISTERED LABEL RATES.

MANUFACTURER	PRODUCT	ACTIVE INGREDIENT	SOIL RATE
Bayer (Research Triangle Park, NC)	Admire PRO	Imidacloprid	10.5 fl oz/A
Syngenta (Greensboro, NC)	Platinum 75SG	Thiamethoxam	11.0 fl oz/A
Valent (Libertyville, IL)	Venom 70SG	Dinotefuran	6 oz/A
	Belay	Clothianidin	12 fl oz/A

Insecticide solutions were prepared as a serial dilution in distilled water at concentration of 0, 0.001, 0.01, 0.1 and 1 ppm. Leaf disks (8.5 cm diameter) were cut from the wrapper leaves of store bought cabbage heads, surface sterilized in 10% bleach water and triple rinsed prior to insecticide treatment. Disks were dipped for 10 s in each insecticide solution and allowed to dry for 2 h. Dry leaf disks were placed into individual 9-cm diam Petri dishes along with 5 harlequin bug 3rd-4th instars (n = 4). Participant insects were field-collected from untreated collard plots grown at Virginia Tech's Agriculture Research and Extension Center at Painter, Virginia. Mortality was determined after 48 and 72 h of exposure to treated disks at room temperature. Nymphs were considered dead when no movement was observed when prodded. The experiment was repeated 3 times for each insecticide.

Excised Collard Leaf Toxicity Bioassays to Determine Residual Efficacy in the Field

Collards (*Brassica oleracea* cv 'Vates'; Brassicale: Brassicaeae) were planted in May, 2010 and again in Jul, 2010 at the Virginia Tech Eastern Shore Agricultural Research and Extension Center at Painter, Virginia. Collards were direct seeded at 3 m spacing and managed on bare ground with minimal inputs other than weed management, which were applied according to conventional management practices (Wilson et al. 2010). Temperatures ranged from 3-34 °C and 12-38 °C through May and Jul experiments, respectively. Insecticide drenches were applied to 6 m, single-row plots in a randomized block design once plants had reached at least 1 true leaf (n = 4; Table 1). Leaves were removed from plots 7, 14, 21 and 28 d after treatment and 5 harlequin bug 3rd-4th instars were isolated to these leaves in Petri dishes (9 cm diam). Insects were observed for mortality or signs of intoxication after 48 h of exposure. Nymphs were considered dead when no movement was observed when prodded, and considered moribund when unable to right themselves.

Statistical Analysis

Analysis of variance was conducted using JMP (SAS Institute, Cary, North Carolina) to test significant difference between percent mortality of treatments in leaf disk bioassays (1 ppm concentration), and both excised-leaf bioassays, and means separation was determined using Tukey's HSD. Control mortality was using Abbott's formula, and then dose-mortality was estimated for each insecticide using probit analysis (EPA Probit Software 2010).

RESULTS

Leaf Disk Bioassays to Estimate LC_{50} Values

There was no difference in mortality among insecticides in leaf disk bioassays ($\alpha = 0.05$). Assays resulted in 60-70% mortality at 1 ppm concentrations for all insecticides (Table 2). Moribund nymphs exposed to clothianidin took up to 72 h before they were reliably determined dead, while 48 h was sufficient for the other 3 insecticides. The LC_{50} for each insecticide was less than 1 ppm; below the equivalent of the registered field rate for all 4 products, with the exception of the product containing thiamethoxam, which contains a lower concentration of active ingredient compared to the other products assayed (Table 2).

TABLE 2. PERCENT MORTALITIES, LC_{50} (PPM) VALUES, AND THE FIELD RATE EQUIVALENT TO EACH NEONICOTINOID LC_{50} VALUE FOR HARLEQUIN BUG NYMPHS EXPOSED TO CABBAGE LEAVES DIPPED IN SERIAL DILUTIONS OF 4 DIFFERENT NEONICOTINOID INSECTICIDES ($N = 3$).

RATE (ppm)	IMIDACLOPRID (48 h)	THIAMETHOXAM (48 h)	DINOTEFURAN (48 h)	CLOTHIANIDIN (72 h)
0.001	5.2%	5.3%	2.1%	5.3%
0.01	4.0%	8.0%	2.1%	7.4%
0.1	14.6%	31.1%	16.0%	32.9%
1	67.7%	73.4%	65.8%	61.9%
LC_{50} (lower - upper)	0.57 (0.32 - 1.26)	0.52 (0.28 - 1.06)	0.39 (0.20 - 0.92)	0.39 (0.16 - 1.50)
Equivalent Field Rate	62%	126%	61%	81%

Mortality adjusted using Abbott's Formula. LC_{50} and lower and upper 95% confidence intervals calculated according to probit analysis (EPA Software 2010).

Excised Collard Leaf Toxicity Bioassays to Determine Residual Efficacy in the Field

All insecticides provided significant mortality relative to the control in bioassays conducted 7 and 14 d after treatment (Table 3) in the May experiment ($F = 20.27$; df = 6, 21; $P < 0.0001$, $F = 17.68$; df = 6, 21; $P < 0.0001$, respectively) and in the Jul experiment ($F = 4.89$; df = 6, 21; $P = 0.0028$, $F = 12.18$; df = 6, 21; $P < 0.0001$, respectively). Imidacloprid was an exception, as this insecticide provided only 7 d of residual efficacy in the May experiment, and mortality due to imidacloprid treatments was not different from the control 7 d after treatment in the Jul experiment, although mortality was higher than the control 14 d after treatment (Table 3). No insecticide resulted in levels of mortality significantly higher than the control at 21 or 28 d after treatment in either experiment.

TABLE 3. PERCENT MORTALITIES (DEAD + MORIBUND) OF HARLEQUIN BUG NYMPHS EXPOSED TO EXCISED COLLARD LEAVES AT 7, 12, 21, AND 28 D AFTER TREATMENT (DAT) BY SOIL DRENCH OF EACH OF 4 NEONICOTINOID INSECTICIDES AT THEIR HIGHEST LABELED RATES.

	MAY EXPT. (% MORTALITY)				JUL EXPT. (% MORTALITY)			
INSECTICIDE	7 DAT	14	21	28	7 DAT	14	21	28
untreated	5 b	3 c	18	8	3 c	10 b	0	5
imidacloprid	80 a	45 b	20	15	25 bc	95 a	25	0
thiamethoxam	100 a	100 a	48	40	63 ab	95 a	25	10
dinotefuran	98 a	100 a	75	63	83 a	90 a	10	5
clothianidin	93 a	88 a	28	18	68 ab	90 a	20	25

Data within a column followed by the same letter are not significantly different according to ANOVA followed by Tukey HSD test of means separation ($n = 4$, $\alpha = 0.05$); there was no significant treatment effect on mortality at 21 and 28 d after treatment.

DISCUSSION

The neonicotinoids imidacloprid, clothianidin, dinotefuran, and thiamethoxam were all toxic to harlequin bug nymphs with LC_{50} levels below 1 ppm. Soil drench-treated plants were found to result in residual mortality of nymphs for roughly 2 wk, compared to approximately 10 d of control by foliar treatments (Walgenbach & Scoof 2011). Imidacloprid-treated collard plants provided significant mortality for 7 and 14 d in May and Jul experiments, respectively. This was shorter than 29 d of protection in the field reported by Kuhar & Doughty (2009). However, in their experiment, as well as any other that uses natural pest populations, residual efficacy is very difficult to assess because the timing and duration of pest infestations is variable.

Critical to the use of neonicotinoids as a systemic insecticide is delivery to the root zone, accomplished via seed treatment, drench application, chemigation, or in transplant water. Residual efficacy over time will be influenced by how quickly the insecticide can be taken up into the plant and the life of the insecticide in the soil, whether it will be leached away or bind to the soil, and how quickly it degrades in the environment. Imidacloprid, thiamethoxam, dinotefuran, and clothianidin are all water soluble, but imidacloprid is less water soluble than the rest, slower to be taken up by plants, and the most likely to bind to soil (Byrne et al. 2007, 2010; Ali & Caldwell 2010).

Imidacloprid had a shorter period of efficacy than the other insecticides in the May experiment and was also slower to provide control in the Jul experiment. A slow uptake of imidacloprid can be expected due to its higher affinity to soil. All insecticides demonstrated shorter than anticipated residual efficacy, and it is possible that the volume of water used in these drench treatments was not adequate to deliver the full rate of the insecticide to the root-zone, or insecticide percolated to areas beyond the root structure.

In conclusion, neonicotinoids provide effective control of harlequin bug nymphs and, while lethal concentrations were not different among the insecticides assayed, the residual efficacy by drench application was variable. A method of application that puts the active ingredient directly in the root zone may be preferred (e.g. seed treatment or transplant water).

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<u>Objectives 2 and 3</u> Identify proper trap crop plant species through lab research/bioassays, and evaluate the efficacy of the trap cropping strategy in the field

A trap crop is a highly attractive plant stand grown to draw pest pressure from a protected crop, which also concentrates pests in a certain part of the field where they can be managed (Hokkanen 1991). Prior to the widespread use of synthetic chemical controls, trap cropping was recommended control of harlequin bug, using radish (*Raphanus sativus* L.), turnips (*Brassica rapa* L.), mustard (*B. juncea* L.), rapeseed (*B. napus* L.), or kale (*B. oleracea* L. Acephala group)

to draw pressure away from cabbage (*B. oleracea* L. Capitata group; Thomas 1915, Chittenden 1920, Fulton 1930). Trap cropping has shown some success in reducing injury of several species of pests attacking cole crop including harlequin bug in broccoli (Ludwig and Kok 1998, Shelton and Badenes-Perez 2006).

A dead-end trap crop is one which is highly attractive for feeding or oviposition but does not allow development of offspring because of lack of nutrition or through chemical defense (Shelton and Nault 2004). Trap crops can be rendered "dead-end" by using conventional pesticides to knock down pest populations. Additionally, neonicotinoid insecticides are known for their low mammalian toxicity, reduced effects on non-target insects, and low potential for environmental hazards (Thomson 2000). Several neonicotinoid products have been found to be effective in controlling harlequin bug when used as a foliar spray (Edelson 2004a,b, Edelson and Mackey 2005a,b, Edelson and Mackey 2006b, Walgenbach and Scoof 2011). Neonicotinoids are water soluble and can be taken up by plants through the roots and translocated through the xylem vessels to plant tissues (Tomizawa and Casida 2005). Application to the root zone, compared to a foliar treatment, allows for better reduction in non-target effects, and is a more attractive method for many growers due to a longer residual efficacy in controlling harlequin bug (Kuhar and Doughty 2009, Wallingford 2012).

Harlequin bug displays many characteristics of a pest that can be successfully managed by trap cropping in that it displays host preference, is highly mobile, and aggregates on field margins. Aggregation is aided by the production of a male-synthesized pheromone that attracts both male and female harlequin bug (Zahn et al. 2008, 2012). There is also potential for a complex of cole crop pests to be controlled by the same strategy (Shelton and Badenes-Perez 2006). It is important that a trap crop can be deployed in a manner that fits into current practices of commercial cole crop managers and does not create an unexpected pest problem. Information on host plant preference will aid in the selection of a proper trap crop species. Augmenting a trap crop with a systemic insecticide could contribute to better control of harlequin bug without applying additional insecticide to the protected crop. Our objective is to (1) identify an attractive host plant for feeding, habitation and oviposition of harlequin bug and (2) evaluate a method of trap cropping to control harlequin bug that is augmented by the use of a systemic insecticide.

Materials and methods

Host preference

Host plants. Potential trap crop species, mustard (*B. juncea* 'Southern Giant Curled'), rapeseed (*B. napus* 'Athena'), arugula (*E. sativa* 'Roquette'), and rapini (*B. rapa*), were compared to collard (*B. oleracea* 'Champion') and bean (*Phaseolus vulgaris* 'Bronco'), a typical cash crop and a non-brassica control, respectively. Plants were grown from seed in the greenhouse in a mix of sphagnum peat moss, perlite and vermiculite (2:1:1), irrigated daily and fertilized weekly with Scott's Water Soluble Plant Food (18-18-21 NPK with micronutrients; Scotts-Sierra Horticultural Product Company, Marysville, OH). Plants used in all experiments were 8-10 weeks old, with no reproductive structures, and at least four true leaves on plants that remained in pots, while plants in field-cages had a minimum of eight true leaves.

Insects. Adult harlequin bugs were field-collected from collards grown at the Virginia Tech Eastern Shore Agricultural Research and Extension Center (AREC) in Painter, VA. In 2009, participants were collected from the field in June and were likely a mix of overwintered and 1st generation adults. In 2010, participants were collected in September and were likely a mix of 2nd and 3rd generation adults. Lab-reared insects were originally collected from mustard and collards grown at the Virginia Tech Kentland Research Farm near Blacksburg, VA. Insects

were reared in mesh cages (30 x 30 x 30 cm; Bioquip Products, Rancho Dominguez, CA) on a mix of cabbage leaves and cauliflower florets, and maintained at 24+ 5°C, ~10% RH, and a photoperiod of 16:8 (L:D) h.

Field-cage choice tests. Host plant preference for harlequin bug feeding, habitation, and oviposition was evaluated at the Eastern Shore AREC in Painter, VA, June 2009 and September 2010. A row of five plants of each species were randomly planted in each of four cages (2 x 2 x 1 m; Bioquip Products, Rancho Dominguez, CA) at 6-8 weeks and experiments were started at 8-10 weeks. Adults (30-50) were introduced in the center of each cage and plants were observed for insects and egg masses at 24, 48, and 72 h after introduction. Weather conditions for the duration of both experiments were generally partly cloudy, and daytime temperatures ranged from 24-30°C.

Oviposition choice test. Oviposition rates were low in both field-cage experiments, so an additional choice test was conducted in the greenhouse at Virginia Tech in Blacksburg, VA in May 2011. One potted plant of each species was placed in each of six wooden framed cages with wire mesh sides (45 x 45 x 60 cm). Three mating pairs were taken from the colony and introduced to cages in the evening and plants were observed daily for egg masses over the following 72 h. This procedure was repeated twice for a total of 12 replications. Weather conditions were generally overcast and greenhouse temperatures ranged from 26-32°C.

Trap crop experiments

Experiments were conducted in summer 2011 at Virginia Tech's Kentland Research Farm near Blacksburg, VA and the Virginia Tech Hampton Roads AREC in Virginia Beach, VA. In mid-May at both locations, collards (*B. oleracea* 'Champion') and mustard (*B. juncea* 'Southern Curled Giant') were direct seeded at 2-4 kg per hectare, and managed with minimal inputs other than weed management, which were applied according to conventional management practices (Wilson et al. 2010). Collard plots consisted of eight 5 m rows spaced 0.3 m apart, each plot being a minimum of 10 m from any other. Experiments were arranged in a randomized complete block design and replicated four times at each site. Treatments included: (1) no trap crop, collard plot as described, (2) mustard border rows, collard plot as described with the addition of a 5 m row of mustard seeded on both sides, and (3) insecticide-treated mustard border rows, collard plot as described with the addition of a 5 m row of mustard seeded on both sides to which a drench application of thiamethoxam + chlorantraniliprole (0.16 L a.i./hectare Durivo; Syngenta, Greensboro, NC) was applied at first observation of harlequin bug in plots.

Plots were scouted weekly for arrival of local populations and, when adults were first observed, insect densities were recorded twice weekly until collard greens reached harvest maturity (10 weeks). On each observation date, ten collard plants and ten mustard plants (when applicable) were observed in each plot for harlequin bug adults, egg masses, and nymphs. When collard greens reached harvest maturity, 20 leaves were randomly selected from each plot and assessed for harlequin bug feeding scars (distinctive white blotches), and number of leaves out of 20 was used to calculate percent damage.

Data Analysis

All data analysis was conducted using JMP (SAS Inst. 2007, Cary, NC). Choice test data were non-normal and did not respond to transformation, so a Kruskal-Wallis test was conducted to test for significant difference between the number of insects and egg masses observed on different plant species; mean separation was evaluated by nonparametric multiple comparisons based on rank sums ($\alpha = 0.05$; Zar 1984). ANOVA followed by Tukey-Kramer HSD comparison tests were conducted to evaluate significant difference between percent damaged collards leaves

observed in collard plots by treatment ($\alpha = 0.05$). A Student's t-test was conducted to evaluate significant difference between harlequin bug adults observed in collard plots versus their accompanying mustard border rows in the trap crop experiment ($\alpha = 0.05$).

Results

Host preference and performance

In 2009 and 2010, significantly more harlequin bug adults were observed on mustard than any other plant species with the exception of arugula at the 24 hour observation in 2010 (Table 1). More adults were observed on rapeseed and rapini than on collard, arugula or bean by the end of the experiment in 2009, while arugula was also preferred over collard and bean in 2010 (Table 1).

In 2009, more harlequin bug egg masses were observed on arugula, collard, mustard, and rapeseed than on rapini or bean, while in 2010, more egg masses were found on rapeseed and collard than any other species, and mustard was not different from bean (Table 1). In the greenhouse cage tests, more egg masses were observed on rapeseed than any other species, while mustard was not different from bean (Table 1).

Table 1. Harlequin bug adults and egg masses (EM) observed on plants in choice tests in June 2009, September 2010, and May 2011; mean number of adults observed on all five plants, per cage for each plant type 24, 48, and 72 hours after introduction to field cages, and mean number egg masses observed on plants over 72 hours in field cages (n = 4), and in greenhouse oviposition choice test (n = 12).

	2009				2010				2011
	Adults			EM	Adults			EM	Greenhouse
Plant	24 hr	48 hr	72 hr	Total	24 hr	48 hr	72 hr	Total	Total EM
arugula	1.0b	0.3b	0.0c	1.8ab	5.8ab	4.8b	4.0b	0.0b	0.1c
bean	0.0c	0.3b	0.0c	0.3c	0.0c	0.0c	0.0c	0.0b	0.0c
collard	1.5b	1.0b	0.0c	3.3ab	2.3b	3.0b	1.0c	2.3ab	0.7b
mustard	10.0a	11.3a	7.3a	3.8a	10.0a	9.0a	11.8a	0.3b	0.0c
rapeseed	1.0b	0.5b	0.5b	3.5a	3.3b	3.8b	3.3b	2.5a	2.2a
rapini	1.5b	0.3b	1.3b	0.8bc	4.8b	5.3b	3.0b	0.8b	0.3bc

Values in the same column followed by the same letter are not significantly different according to Kruskal-Wallis ($p < 0.05$) and means separation was determined by nonparametric multiple comparisons based on rank sums.

Trap crop experiments

Harlequin bugs appeared on plants well before harvest in all experiments and the insecticide applications to treatment 3 plots occurred at week 5 and 3 for Virginia Beach, and Blacksburg, respectively. Peak numbers of adults occurred after week 8, and the subsequent generation of nymphs reached a peak after week 10.

More harlequin bug adults and nymphs were observed in mustard border rows than in accompanying collard plots on several observation dates for trap crop treatments, while there was no difference in egg masses between mustard and collards ($\alpha = 0.05$; Fig. 1). This difference was seen earlier in untreated mustard plots, while differences were not seen in insecticide-treated plots until 60-70 days after treatment (Wallingford 2012).

More damaged collard leaves were observed in plots with no trap crop than in plots with mustard border rows at Virginia Beach and Blacksburg ($F = 37.56$; $dF = 2, 9$; $p < 0.0001$, $F = 6.45$; $dF = 2,9$; $p = 0.0183$, respectively), while there was no difference between plots protected by either untreated or insecticide-treated trap crops (Fig. 2).

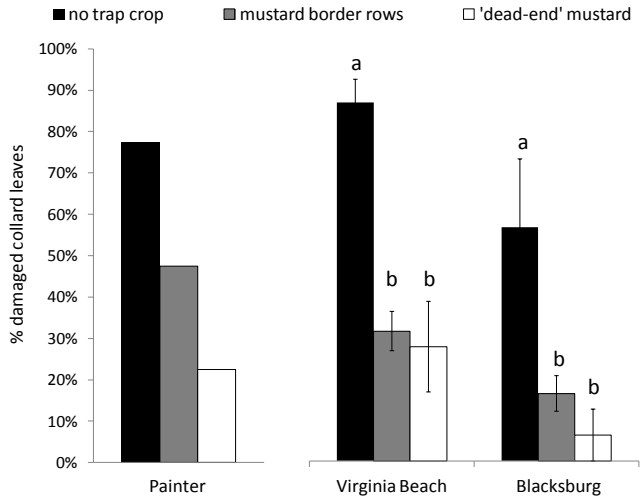

Figure 1: Percent of collard leaves damaged by harlequin bug observed at harvest (10 wks) at three Virginia locations. All but one plot was destroyed by drought at Painter in July 2010, so only one replication is reported. Values from Virginia Beach and Blacksburg sites are the mean ($\pm$SE) of four replications planted in May 2011. Bars with the same letter are not significantly different according to ANOVA, Tukey's HSD ($\alpha = 0.05$).

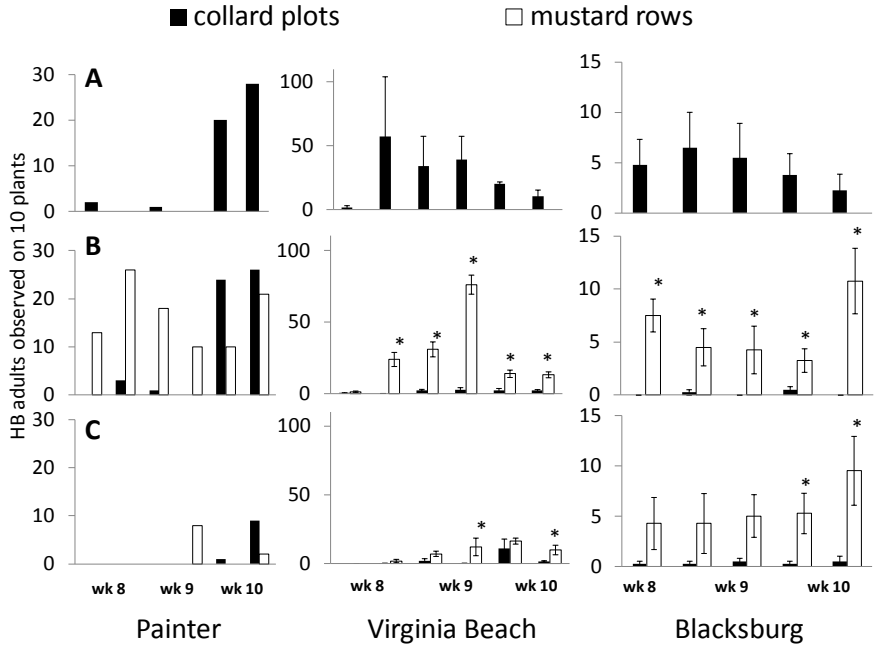

Figure 2: Harlequin bug adults observed in collard plots and their accompanying mustard border rows, the number observed on 10 plants, (A) collard plot alone, (B) collards with untreated mustard border rows, and (C) collard plots with insecticide treated mustard border rows. All but one plot was destroyed by drought at Painter in July 2010, so only one replication is reported.

Values from Virginia Beach and Blacksburg sites are the mean (±SE) of four replications planted in May 2011. Bars with asterisks indicate observation dates where there were significantly more adults observed on mustard border rows than their accompanying collard plots, according to a Student's t-test ($\alpha = 0.05$).

Discussion

Harlequin bug demonstrated a strong preference for mustard over collard for feeding and habitation, confirming historical recommendations and previous reports of host preference (Paddock 1915, Ludwig and Kok 1998). A trap crop of mustard decreased the number of damaged leaves seen in collard for up to 10 weeks, a time frame comparable to that of a cabbage or broccoli crop started from transplants, although some cole crops started from seed would require a longer period of protection.

There was no difference in control between plots with untreated versus thiamethoxam-treated mustard trap crops (Fig. 2) and this was likely due to the peak colonization of harlequin bug occurring after the period of residual efficacy of the insecticide. The rate of harlequin bug colonization was slow, generally 3-4 weeks between the first observation and peak populations of harlequin bug adults in plots, which resulted in the highest insect pressure occurring when residual efficacy of one drench application of thiamethoxam was sinking (Wallingford 2012). Without a proper action threshold, the use of a systemic insecticide may be viewed as unnecessary for the 10 week time period evaluated, although control of the pest population is highly recommended. Control of congregated harlequin bug could also be accomplished with a foliar insecticide treatment, vacuuming, burning or tilling under that trap crop, which will destroy eggs and nymphs.

Oviposition choice data differed between years, and this may be due to the variability in the time of year during which experiments were conducted (Table 1). Ovipositing females in the September 2010 experiment may have been more selective than those used in June 2009, because shorter days indicate that the season is ending. Variation in tactile cues from the plant surface may have played a role in oviposition choice. Although the effect of tactile cues on harlequin bug is unknown, the presence of pubescence on the leaf surface and increased waxy bloom have been reported to affect the behavior of other phytophagous insects and their natural enemies (Lamb 1980, White and Eigenbrode 2000).

Harlequin bug females did not show a preference for laying eggs on mustard in the field as there were no differences between the number of egg masses observed in mustard border rows versus accompanying collard plots; however, nymphs did show a preference for mustard (Fig. 1). Oviposition choice and the subsequent nymphal densities probably did not contribute to the overall damage observed on collard leaves during the time frame of the field experiments, as nymphs were not observed until late in the experiment. Nymphs are highly mobile and capable of finding host plants, although nymphal host preference is unknown. The movement of ovipositing females and their nymphs between trap crop and protected plants should be investigated for longer infestation periods.

Although mustard was found to be the most consistently preferred plant species for feeding and habitation, rapeseed and rapini were also preferred over collard in choice tests (Table 1). There is potential for several plant species or varieties to be used as a trap crop and a mix of more than one plant species is potentially the most effective trap crop. Furthermore, using one or more of these plant species may control a complex of pests. *Brassica juncea*, also known as Indian mustard, has been previously cited as an effective trap crop for harlequin bug (Ludwig and Kok

1998), as well as flea beetle and several lepidopteran pests of cole crops (Luther et al. 1996, Smyth et al. 2003).

Trap cropping is a viable option in several farming systems and is currently used regularly on organic farms. Often a preferred host plant will slow movement of pest species to a great enough extent that no further management is necessary. If management is required, insects can be hand-picked or vacuumed off these plants, and there are several organically certified insecticides whose active ingredients include spinosad and azadirachtin (Edelson and Mackey 2006b, Overall et al. 2008) that provide some efficacy on harlequin bug. Trap cropping can also be augmented with natural enemies, such as entomopathogens, parasitoids and predators, and can improve overall arthropod diversity which can maintain pest populations below economic thresholds (Correa-Ferreira and Moscardi 1996, Aguilar-Fenollosa et al. 2011).

In summary, knowledge of a predictable behavior in harlequin bug can be used to devise management strategies for its control in cole crops. A border row of mustard reduced harlequin bug injury in collard by roughly 50%, without the use of insecticides. Although there was no difference in control between untreated and insecticide treated plots, the use of insecticides may be required for management of harlequin bug aggregations on trap crops, in order to reduce on-farm pest populations which may infest subsequent plantings of cole crops.

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GOALS AND OUTCOMES ACHIEVED

- Harlequin bug, *Murgantia histrionica* (Hahn), is a pest of cole crops in the USA. Laboratory toxicity assays revealed that the neonicotinoid insecticides imidacloprid, thiamethoxam, dinotefuran, and clothianidin are toxic to harlequin bug nymphs; LC_{50} = 0.57, 0.52, 0.39, and 0.39 ppm, respectively.
- Field experiments were conducted to evaluate the efficacy of the aforementioned insecticides over time when applied as a one-time soil drench. Each of the 4 neonicotinoids provided significant control of harlequin bug for at least 14 days after drench application. Proper application (i.e. proper amount of water in the drench) is critical for delivery to the root system.
- Mustard (*Brassica juncea* 'Southern Curled Giant') was found to be consistently more attractive than collard (*B. oleracea* 'Champion') in choice tests and considered a candidate for a trap crop species.
- Collard plots with mustard border rows had less harlequin bug damage (5-20% leaves damaged) than collard plots without a trap crop (55-85% leaves damaged). This was due to a clear preference for mustard over collard at the field level. There was no difference in control between mustard trap crops with and without systemic insecticide, but heaviest insect pressure occurred when insecticide residual efficacy was low.

- Demonstration plots of mustard were established at 7 commercial farms growing cole crops and were monitored for harlequin bug.
- **Farmer Adoption.** Several farmers surveyed were enthusiastic about adopting trap cropping in the future. Many farmers surveyed had come across this concept by accident and were currently "trap cropping" in some form, although they had not heard of this term previously. In 2011, demonstration plots were established at 8 commercial organic and conventional farms. One participating farmer adopted a mustard trap crop in his 2012 kale crop. All non-organic growers expressed an interest in using neonicotinoids in the case of a harlequin bug outbreak in their crops.

BENEFICIARIES

- Vegetable growers in Virginia who produce cole crops (collards, kale, cabbage, broccoli, etc…) will benefit from the knowledge gained on methods to effectively control harlequin bug, which has become a pest of increasing concern in the state.
- Without effective control, harlequin bug can result in up to 50% loss of the crop.
- Soil drenches (transplant drenches) of four different neonicotinoid insecticides were shown to provide effective control of harlequin bug for up to 14 days after application. These insecticides offer a less disruptive insecticidal control option for growers that should not destroy natural enemies of the lepidopteran pests. The neonicotinoid insecticides will also control aphids and flea beetles.
- Trap cropping offers organic vegetable growers with an effective control option for harlequin bug.

This research project contributed to the funding and research of Ms. Anna Wallingford, who graduated in May 2012 with a Ph.D. The concepts and data presented in this report were presented by her at several venues including vegetable grower meetings and extension field days, and were published in conference proceedings and peer-reviewed scientific journals.

Publications:

Wallingford, A.K., T.P. Kuhar, P.B. Schultz and J.H. Freeman. 2011. Harlequin bug biology and pest management in brassicaceous crops. J. Integ. Pest Mngmt. 2(1): 2011; DOI: 10.1603/IPM10015

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Wallingford, A.K., T.P. Kuhar, D. G. Pfeiffer, D. B. Tholl, J. H. Freeman, H. B. Doughty, and P.B. Schultz. Host plant preference of harlequin bug (Hemiptera: Pentatomidae), and evaluation of a trap cropping strategy for its control in collard. J. Econ. Entomol. (Accepted for publication)

Presentations:

Wallingford, A. K., T. P. Kuhar, and P. B. Schultz. 2012. Evaluation of a trap cropping strategy for control of harlequin bug in collard. International Integrated Pest Management Symposium, March 27-29, Memphis, TN.

Wallingford, A., T. Kuhar and P. Schultz. 2011. Investigating the role of olfaction in the harlequin bug (*Murgantia histrionica*), insect pest of cole crops. Virginia Academy of Science Annual Meeting, Richmond, VA, May 25, 2011.

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Wallingford, A.K., P. Schultz, and T.P. Kuhar. 2010. Harlequin bug host plant preference and potential for trap cropping in brassica crops. 2010 Eastern Shore Annual Research Field Day, Painter, VA, July 14, 2010.

- All research has been completed and three peer-reviewed scientific journal publications have been written.
- An additional grower-level extension publication on trap cropping is planned.

2 more additional published journal articles:
Wallingford A. K., T. P. Kuhar, D. G. Pfeiffer, D. B. Tholl, J. h. Freeman, H. b. Doughty, and P. B. Schultz. 2013. Host plant preference of harlequin
bug (Hemiptera: Pentatomidae), and evaluation of a trap cropping strategy for its control in collard. J. Econ. Entomol.
106(1): 283-288.

Wallingford A., T. KUHAR, P. SCHULTZ. 2012. Investigating the role of olfaction in the host plant selection of harlequin bug
(Murgantia histrionica), pest of cole crops. Virginia J. of Sci. 62 (1 & 2): 17.

Presentations:
Wallingford A., T. KUHAR, P. SCHULTZ. 2012. Evaluation of a trap cropping strategy for control of harlequin bug in
collard. International Integrated Pest Management Symposium, March 27-29, Memphis, TN.

Kuhar T. 2012. Recent field trials with novel insecticides for cole crops. Broccoli Growers' Meeting, March 22, Hillsville,
VA.

Kuhar T. 2012. Vegetable pests update. Grow Local, Buy Local: Vegetable Production Workshop and Community
Showcase, Rockingham County Fairgrounds, January 30, Dayton, VA.

Kuhar T. 2012. Insect management and spray programs for vegetable production. Commercial Pesticide Application
Recertification Training, January 26, Roanoke, VA.

LESSONS LEARNED

Grower adoption

Many organic growers approached for collaboration in demonstration plots showed a lack interest in the project although they were enthusiastic about trap cropping as a practice. Many of these disinterested growers reported using a trap crop-type method with which they were currently satisfied. One of these growers expressed a disinterest in participating in a research project that involved the use of insecticides, although this grower was not requested to use insecticides himself.

Many non-organic growers approached for collaboration in demonstration plots showed a lack of interest in the project, mainly because they did not consider harlequin bug as a target pests species. However, many non-organic growers were very enthusiastic about participating in future neonicotinoid residual efficacy trials. The main concern regarding trap cropping revolved around desire to have a "clean" crop and an aversion to any level of insect presence or feeding damage.

Other concerns of both organic and non-organic growers revolved around added labor, loss of production area and creating a greater pest population with the addition of a highly attractive crop. Growers that were enthusiastic about adopting trap crops were those that were open to the use of insecticides, but considered themselves "sustainable" or practiced integrated pests management.

CONTACT INFO
Thomas P. Kuhar
Associate Professor
Department of Entomology
Virginia Tech
216 Price Hall
Blacksburg, VA 24061-0319
Ph: 540-231-6129
FAX: 540-231-9131
e-mail: tkuhar@vt.edu

Stink Bug populations, Injury and Control on Primocane-bearing Caneberries

Douglas Pfeiffer
540-231-4183
dgpfeiff@vt.edu

I. Project Summary

Caneberries are becoming important alternative crops in Virginia, and represent a potentially profitable enterprise for both large and small-scale growers. Based on a conservative return of $6,000 per acre for blackberries and $4,435 per acre for raspberries, the estimated returns for blackberry and raspberry production in Virginia are $960,000 and $355,000, respectively. In the United States raspberries are the third most popular fresh use berry.

On caneberries in Virginia, several stink bug species occur on the foliage and fruit of primocane bearing varieties. However, little is known about which species of stink bugs use caneberries as feeding and/or reproductive hosts. Species which use caneberries as feeding hosts would have adults alone on the crop, while those using caneberries as reproductive hosts would lay eggs here, allowing nymphs to also feed and develop on the crop. This project will identify stink bug species affecting caneberries, their relative abundance and feeding injury, and the time period that they are feeding on caneberries. This information will allow growers to make sound pest management decisions.

Management of berry feeders is currently difficult due to inherent problems with timing and regulatory issues. Stink bugs are often present close to harvest. Pesticide use is limited by long preharvest intervals and loss of registrations through the Food Quality Protection Act (FQPA). Alternative pesticides are being developed; however, these compounds are often more expensive than the displaced tools and have narrower spectra of activity. Some are disruptive of integrated pest management (IPM) programs, because they are very toxic to beneficial species. There is a need for research to determine the best use of new chemicals. This project will provide replicated field trial data on the efficacy of conventional insecticides, low-risk pesticides, and organic alternatives against stink bugs.

This project had three objectives:

1. Determine which stink bug species occur in Virginia caneberries and whether stink bugs use caneberries as feeding and/or reproductive hosts.
2. Determine efficacy of selected conventional insecticides, low-risk pesticides, and organic alternatives against stink bugs in caneberries.
3. Determine the mechanisms of stinkbug feeding injury in caneberries.

The project was intended to provide data helpful to fruit producers in managing stink bugs in general, and a new invasive pest, brown marmorated stink bug, in particular.

II. Project Approach

Objective 1. Determine which stink bug species occur in Virginia caneberries and whether stink bugs use caneberries as feeding and/or reproductive hosts

Yellow pyramid traps designed to visually attract stink bugs were placed in bordering fields and within the raspberry plots. Traps were baited with methyl (2*E*,4*Z*)-decadienoate, an aggregation component that readily attracts both sexes and nymphs of *Euschistus* spp. (brown stink bugs), and in 2012 with a blend expected to reflect that actual pheromone of brown marmorated stink bug. Traps were monitored frequently from June through mid- October to determine when stink bugs are present and when they move into raspberries.

Visual counts and beat sheet sampling were used within the raspberries to verify pheromone trap data, and to record which species are reproducing in the raspberries. This work was performed at Kentland Farm.

Objective 2. Determine efficacy of selected conventional insecticides, low-risk pesticides, and organic alternatives against stink bugs in caneberries

In 2011, raspberry plots of four selected varieties will be treated with selected materials and an untreated control at the beginning of bloom and when needed. A CO_2 powered backpack sprayer was used to apply treatments. Four replications per treatment will be used, allocated in a randomized complete block design. Pesticides with different modes of action in insect neurotransmission were used. The organophosphate malathion acts on the acetylcholinesterase enzyme, the pyrethroid etofenprox is a sodium channel modulator and the neonicotinoid dinotefuran binds at a specific site on postsynaptic nicotinicacetylcholine receptor inhibiting insect neurotransmission. In addition to being applied alone, etofenprox and dinotefuran were also applied with the synergist piperonyl butoxide as combined treatments.

Stink bugs were counted twice weekly on treated plots. Data will be transformed before statistical analysis.

Chemical control data were collected in the first year of the study (2011). In the second year (2012) stink bug populations were lower than anticipated in our plantings so control objectives were not practical; no control data were developed.

Objective 3. Determine the mechanisms of stink bug feeding injury in caneberries.

Exterior evaluations were to be made to determine feeding sites. Receptacles (the conical portion remaining after removal of berry) were to be examined under a light dissecting microscope as a first step in determining feeding at this site. Further steps were to be taken to stain tissues for stink bug stylet paths, to confirm feeding on the receptacle. Stained samples will be evaluated using conventional light microscopy. In addition, a scanning electron microscope will be used to evaluate feeding injury in receptacle tissue. Little progress was made in this area because of problems with the dye procedure.

Results of our work have been disseminated in several types of conferences. Here is a list:

Cumberland-Shenandoah Fruit Workers Conference is an annual gathering of fruit crop protection specialists in eastern North America.

> Basnet, S., D. G. Pfeiffer, C. A. Laub, T. Kuhar and R. Mays. 2011. Feeding injury and management of brown marmorated stink bug in Virginia vineyards and raspberry plantings. Proc. 87th Cumberland-Shenandoah Fruit Workers' Conf., Winchester, VA. Dec. 1-2.

Entomological Society of America is the national organization of entomologists; conferences are held at both the national level and regional level (Eastern Branch ESA covers Virginia through eastern Canada).

> Basnet, S., D. G. Pfeiffer, T. P. Kuhar and C. Laub. 2012. Seasonal abundance and biology of brown marmorated stink bug *Halyomorpha halys* (Stål) (Hemiptera:

Pentatomidae), in Virginia vineyards. Entomol. Soc. Am. Annu. Meeting, Knoxville TN Nov. 11-14.
Basnet, S., D. G. Pfeiffer, T. P. Kuhar and C. A. Laub. 2011. Field evaluation of pesticides having different modes of actions against brown marmorated stink bug in raspberry plantings. Entomol. Soc. Am. Annual Meeting, Reno NV. Nov 13-16.
Basnet, S., D. G. Pfeiffer, T. P. Kuhar and C. A. Laub. 2013. Stink bug community in primocane-bearing raspberry planting in southwest Virginia. Entomol. Soc. Am. Eastern Branch, Lancaster PA. Mar 17-19.

Basnet, S. and D. G. Pfeiffer. 2012. Feeding injury and management of brown marmorated stink bug in Virginia vineyards and raspberry plantings. Entomol. Soc. Am. Eastern Branch, Hartford CT. Mar 16-19.

I was invited to share our stink bug research at a conference of small fruit producers at Virginia State University (state berry conference).

Pfeiffer, D. G. 2013. Spotted wing drosophila and brown marmorated stink bug - the biggest challenges to berry growers. Sixth Virginia Berry Conference. Virginia State Univ., Petersburg. Mar 14.
Pfeiffer, D. G. 2012. Caneberry pest management: Borers, thrips and invasives. Fifth Annual State Berry Conference. Virginia State Univ., Petersburg. Mar 15.

III. Goals and Outcomes Achieved

 An understanding of within-farm variation in numbers of brown marmorated stink bug was obtained.

In the stink bug survey, data were developed on the stink bug species present. The species in our samples were: **(2011)** Brown stink bug 56.4%, brown marmorated stink bug 23.6%, harlequin bug 7.3%, spined soldier bug (a valuable predatory species) 5.4%, green stink bug 3.6% and twice-stabbed stink bug 2.6%, and **(2012):** Twice-stabbed stink bug (33.0%), brown stink bug (29.5%), green stink bug (19.6%), brown marmorated stink bug (13.4%), harlequin bug (3.6%) and spined soldier bug (2.7%). Our results indicate the need for further work on within-farm movement of brown marmorated stink bug. In another section of the research farm, in vegetables closer to the New River, almost all stink bugs seen were brown marmorated stink bug.

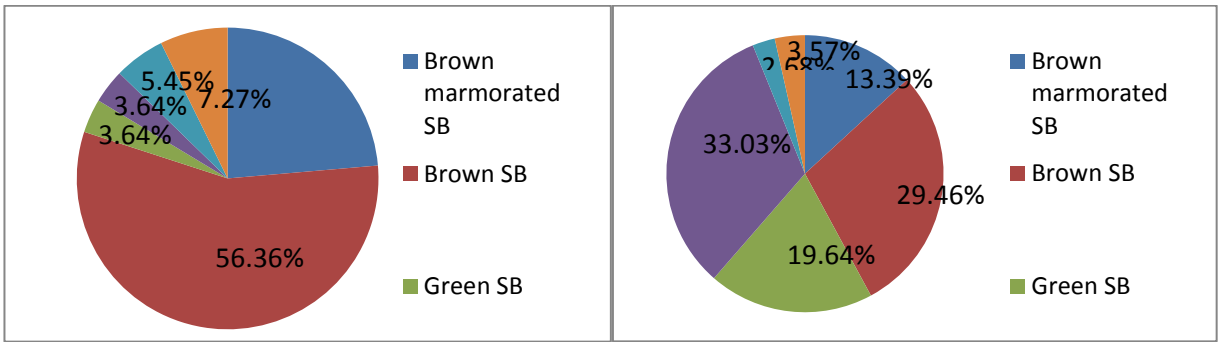


Fig. 1. Stink bug species composition in primocane-bearing raspberry planting at Kentland Farm, Montgomery County, Virginia – 2011 and 2012

Our chemical control data showed that all materials tested caused significant mortality of brown marmorated stink bug, with no statistical differences among insecticides. Differences became most pronounced 6 days after treatment. The addition of the synergist PBO did not cause a significantly improved degree of mortality, but because there was a consistent numerical trend, this should be further investigated with greater replication.

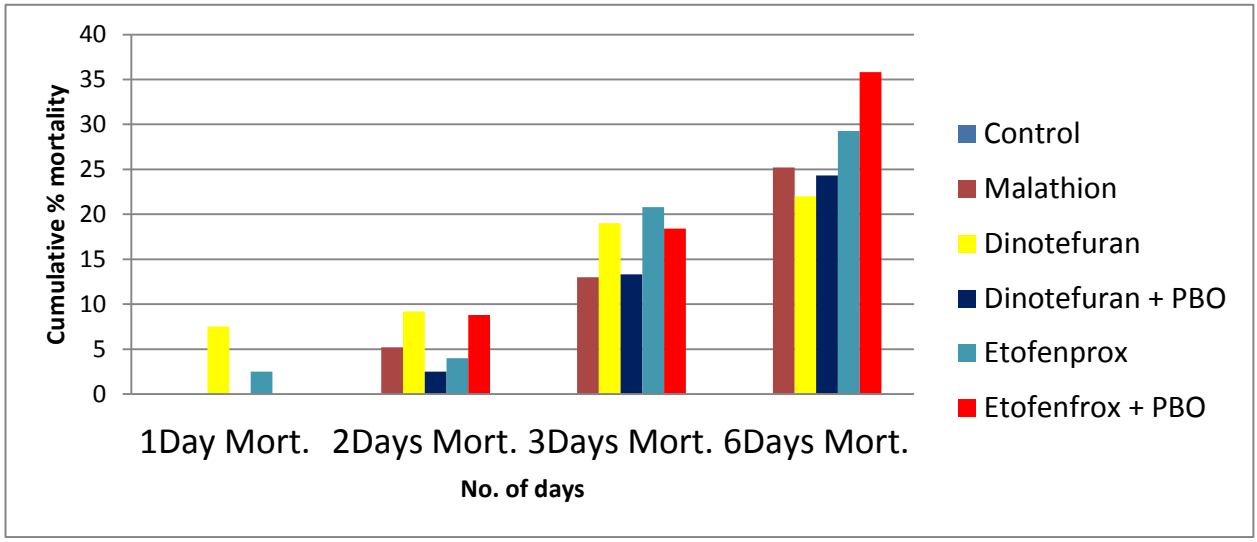


Fig. 2. Cumulative percent mortality of caged brown marmorated stink bug when treated with pesticides at standard rate, 1, 2, 3 and 6 Days after treatment.

Percentage mortality data for 6 DAT were analyzed as completely randomized ANOVA. The mortality data were compared among treatments using Tukey-Kramer HSD mean separation procedure at $P \leq 0.05$ level of significance. There was no difference among chemical treatments; all had the same degree of mortality above control mortality (Fig. 3).

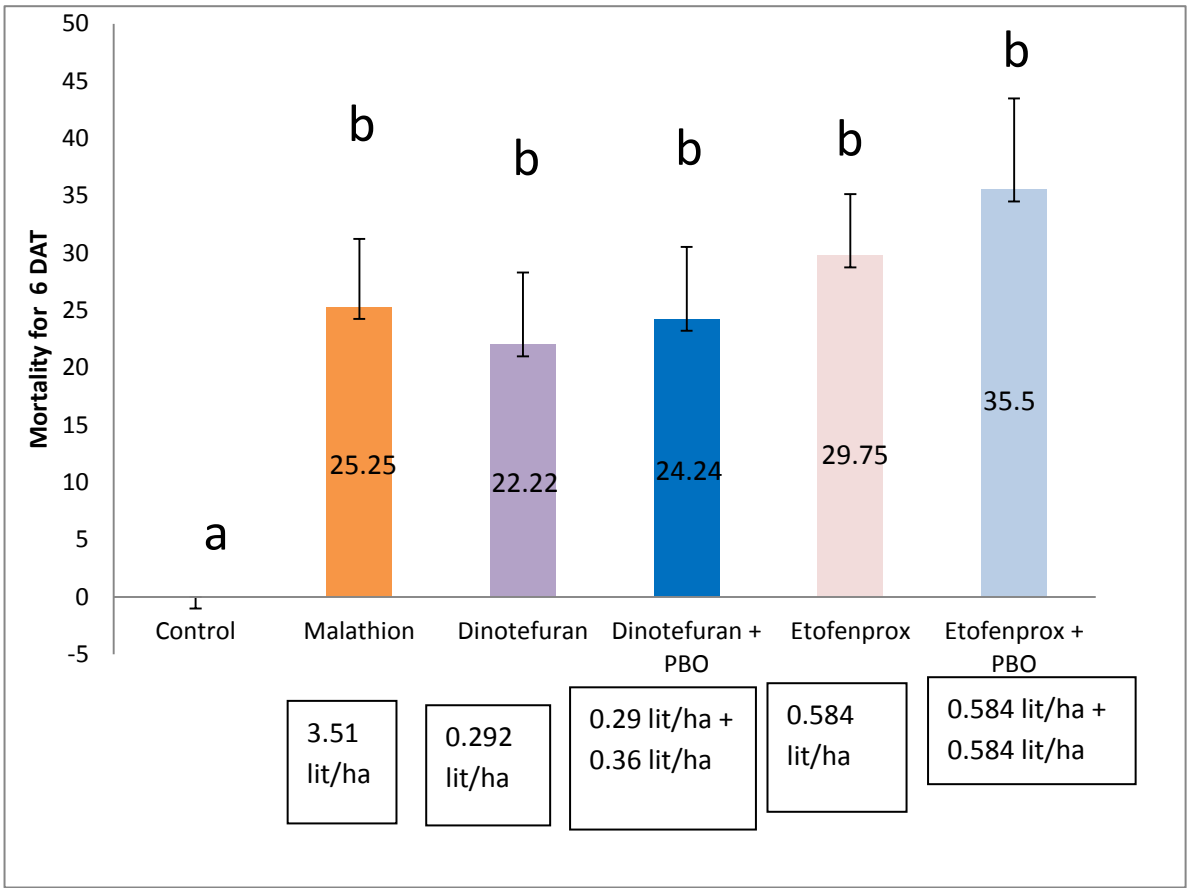


Fig. 3. Mortality 6 DAT of brown marmorated stink bug when treated with pesticides at standard rate. Surviving brown marmorated stink bug treated with pesticides were significantly different from the untreated plots (F = 4.7, df = 5, P < 0.039). Bars with different letters are significantly different.

Dies were unsuccessful in staining for stylet sheaths of stink bug feeding because the white receptacle tissue is highly absorbant, and dies were readily absorbed by the entire structure.

IV. Beneficiaries

 The potential beneficiaries are small fruit growers primarily, but also growers of any commodity affected by brown marmorated stink bug.

The audience at Cumberland-Shenandoah Fruit Workers Conference is divided into disciplinary break-out session (entomology, plant pathology, and horticulture). There are generally 60-80 people attending the entomology presentations. This includes university, USDA and corporate entomologist mainly from the mid-Atlantic region, but including New England, New York, Michigan and Oregon. Information shared in these presentations help shape recommendations in states beyond Virginia.

Entomological Society of America (ESA) national conferences are normally attended by 2800-3000 people, and branch meetings by about 200 people. Oral presentations are normally in

sessions of fruit-related talks, attended by 20-60 entomologists. Posters are available to the general audience at the conference.

The state berry conference is an opportunity to share research results directly with farmers. The conference was attended by about 170 growers. Following the talk, individuals followed me into the hallway to continue discussion on these issues.

V. Lessons Learned

 Unexpected species may dominate the stink bug community in individual settings. Dominant species within a planting may shift from year to year. Experiments may have to be carried in out in more than one location.

 All modes of action tested provided control under our experimental conditions. The synergist PBO did not result in significantly increased mortality, but this should be further investigated.

 We were unable to carry out stink bug control trials in the second year of this project. This is partly due to climatic conditions that caused lower than expected stink bug populations throughout the region. In the future, we will try to plan trials in more locations in order to maximize the chances of finding useful population densities.

VI. Additional Information

 Information developed on brown marmorated stink bug will be updated when appropriate in my brown marmorated stink bug web page: http://www.virginiafruit.ento.vt.edu/BMSB.html

Production and Marketing of High Tunnel Grown Ginger Roots in Virginia

Reza Rafie
804-526-5840
arafie@vsu.edu

I. Project Summary

Nationally, consumer demand for locally grown fresh fruits and vegetables is on the rise. This trend in combination with higher gas prices adding to the transportation cost to supply fresh produce over long distances has forced produce retailers, brokers and wholesalers to look for sources of local and regional supply. Clearly, this is an opportunity for local growers to capitalize on this trend and concentrate on growing crops with proven market demand.

Ginger root (*Zingiber officinale* Roscoeis) is one of the most ancient plant species known to man and is used for many purposes. It is believed to be native to Malaysia or India in Asia. Ginger is mainly produced in tropical and sub-tropical regions. The plant produces underground rhizomes, which are harvested 9-10 months after planting. Fresh ginger root is an important Asian spice that has crossed over and is being used by many American. Ginger cannot be grown under field conditions in Virginia as it takes 9-10 months from planting the seed to the harvest. The average growing season in Virginia under field conditions is not more than 7 months. However, it is possible to grow ginger under a high tunnel condition. Due to considerable demand for locally grown food and the recognition of its health benefits in an increasingly health conscious society makes fresh ginger root a specialty crop with considerable niche market potential. This project provided funding for two Virginia growers to initiate high tunnel ginger production. The first two years' production information for both growers showed that high tunnel ginger production can be profitable. One grower was able to market 50% of his ginger at the wholesale market at an average price of $6.00 per pound. This grower marketed the rest of his ginger at the Community Supported Agriculture (CSA) marketing channel and was able to receive even higher prices for his product. The second grower sold 80% of his high tunnel grown ginger at farmers market and received an average price of $10.00 per pound for his product. This grower was able to add value to his ginger by producing ginger ice cream and was able to market his ice cream at his retail store and received premium prices for his ginger ice cream. Both of these growers will continue growing and marketing ginger in the future.

II. Project Approach

a. Production

Nationally, consumer demand for locally grown fresh fruits and vegetables is on the rise. This trend in combination with higher gas prices adding to the transportation cost to supply fresh produce over long distances has forced produce retailers, brokers and wholesalers to look for sources of local and regional supply. Clearly, this is an opportunity for local growers to capitalize on this trend and concentrate on growing crops with proven market demand.

Ginger root (*Zingiber officinale* (Roscoeis)) is one of the most ancient plant species known to man and is used for many purposes. It is believed to be native to Malaysia or India in Asia. Ginger is mainly produced in tropical and sub-tropical regions. The plant produces underground rhizomes, which are harvested 9-10 months after planting. Fresh ginger root is an important Asian spice that has crossed over and is being used by many American. Ginger cannot be grown under field conditions in Virginia as it takes 9-10 months from planting the seed to the harvest. The average growing season in Virginia under field conditions is not more than 7 months. However, it is possible to grow ginger under a high tunnel condition. A high tunnel structure is an unheated greenhouse covered with clear plastic and is primarily used for season extension both at the beginning and at the end of the production period. This structure is affordable for most farmers. A 48 Ft. long by 30 Ft. wide high tunnel costs less than $5500.00. Many Virginia growers are building high tunnel in their farms in order to extend their production season for a variety of fruit and vegetable. High tunnel plays an important role in allowing the production of ginger in Virginia.

A proposal was written and submitted for funding to Virginia Department of Agriculture and Consumer Services (VDACS). The project was funded in September 2010. In October-November 2010, in collaboration with different County Extension Agents, two growers were selected to participate in this project and to grow high tunnel ginger. The project provided technical and financial support in building a 48 Ft. long by 30 Ft. wide high tunnel on each of the two growers' farms. The high tunnels were built in March 2011. In January 2011, sufficient ginger seed-pieces were purchased by Virginia State University (VSU) to produce one gallon potted ginger plants. A total of 400 ginger plants were grown in the greenhouse facilities of VSU. In May 2011, the ginger plants were transported from VSU to each of the two high tunnels of the collaborating growers and then were transplanted in the ground inside their high tunnel. Therefore each grower received 200 ginger plants in their high tunnel.

Technical assistance was provided in the ginger crop management. This included; soil preparation, planting, irrigation, fertilization, mounding, pest control harvesting and marekting. Starting in Mid-September of 2011, each grower initiated partial harvest of their ginger. Harvested ginger was cleaned, washed, and air dried before it was sent to the market. The ginger harvest continued until December 2011. Each grower saved 20 plants as a source of ginger seed-piece for the next planting year (2012).

In November 2011, A 'Ginger Field-Day' was organized and conducted in one of the collaborating grower's farm. 35 farmers participated in this training and learned about the production, harvesting, marketing and value added product development with ginger roots.

In the second year of this grant project (2012), each grower saved enough ginger seed pieces from the 2011 production season, and produced 200 one gallon ginger plants the same way it was done in the previous year by the VSU faculty. The one gallon ginger plants were planted in May 2012 in the high tunnel by each grower. In the 2012 production season, each grower played an active role in the seed production, planting and

management of the crop than the previous year. In 2012, the harvest initiated in September and continued until December.

In November 2012 a 'Ginger Field-Day' was conducted in one of the collaborating farmer's farm, and 40 farmers participated in this event. In the 2012 ginger field-day, the collaborating farmers shared with the participating farmers their ginger growing and marketing experience.

b. Marketing

The two growers who participated in this project received training in marketing and were able to market their product to different marketing channels including wholesale, retail (community supported agriculture (CSA), farm retail store, and farmers markets) markets. The marketing result for this project was economically very profitable. One grower produced an average yield of 6 lbs/plant. This will add up to be approximately over 1100 lbs of ginger. This grower was able to sell his ginger at an average price of $6:00/pound. The net return from the sales of ginger roots to this grower was very profitable. This grower sold most of his ginger to the wholesale market.

The second grower sold all his harvested ginger at a retail farm store he and his wife are managing. Although this grower did not have high yield, he was able to sell his ginger in his retail store for $12.00/pound. This grower added value to his ginger and produced and sold ginger ice cream at his retail store. The customers buying ginger ice cream paid premium prices for locally produced ginger iced cream. This grower indicated that producing ginger ice cream was a success.

The marketing results for the duration of two years when this project was conducted was very profitable for the participating growers, and they are currently preparing independently on their own to plant ginger for the 2013 production season.

III. Goals and Outcomes Achieved

The proposed measurable outcomes of this project were:

The goal of this project was to provide Virginia growers with an alternative specialty crop with considerable niche market potential. The following were expected outcomes for this project :

1. A minimum of 20 growers will establish commercial high tunnel (96 feet long by 26 feet wide) production of fresh ginger roots as a new farm enterprise option by 2013.
2. A minimum of 15 of these growers will develop production, post-harvest and marketing skills and knowledge to produce high tunnel fresh ginger for direct marketing by 2013.
3. A minimum of five (5) of these growers will develop production, post-harvest and marketing skills and knowledge to expand their high tunnel production of fresh ginger roots for regional wholesale and produce auction markets.

4. A complete digital video of high tunnel production of ginger root will be produced professionally and will be made available to all County Extension offices in Virginia for growers to access. This video will be divided into different sections, shortened and will be made available on 'You-tube' and other social web media for the public to learn about production harvesting, marketing and health benefits of ginger root.

Impact of this project:
As a result of this project, currently an additional 10 growers are producing and marketing high tunnel Virginia grown ginger. One grower in the Richmond, Virginia area has been very successful in producing high quality ginger and selling it to local restaurants and at local farmers markets, and asking for premium prices of $18.00/pound for his ginger. This particular grower as interviewed by several local TV stations about his ginger production experience.

Locally Virginia grown ginger has become an important crop both for growers and consumers. The health benefits of ginger roots as a spice are numerous, and Virginia consumers have been very supportive of Virginia grown ginger by purchasing it at local farmers markets and retail grocery stores. As indicated ginger production has been very profitable for those growers who are currently growing it. It is clear that this grant project played an important role in assisting growers on how to grow, harvest and market locally grown ginger. A You-Tube Video was produced and now is available on the internet for growers and consumers who may be interested in learning how to grow and market ginger as a new crop, http://www.youtube.com/watch?v=UYDiQ5464KM

As a result of this grant projects an Extension publication was developed and is currently available to farmers. See the attachment.

IV. Beneficiaries

Groups and other operations that gained benefits from the high tunnel ginger production and marketing project were:

- Virginia consumers shopping at their local farmers markets now are able to have access to locally grown ginger September-January.
- Members of the Virginia Association for Biological Farming.
- Virginia Farm Bureau
- Members of several local Farmers Market Associations
- Over 20 local chapters of Virginia Master Gardeners
- Virginia Cooperative Extension – Agriculture Extension Agents
- Growers throughout Virginia

V. Lessons Learned

- Introduction a new crop such as ginger that has health benefits to consumers can be profitable for growers.
- Adding value to ginger root can be very profitable. Therefore growers are encouraged to investigate how to add value to their ginger roots. As mentioned, one grower produced ice cream. Other growers are considering gingerale, ginger candy and other new value added products.
- As ginger is a niche crop, growers need to be aware that too much production (over supply) can saturate the market, and therefore, bring down the prices.
- Promoting the consumption of locally Virginia grown ginger among consumers who are not familiar with this crop needs the active participation of all farmers growing ginger.
- High tunnel structure is very important in growing high quality Virginia grown ginger and farmers must consider constructing a high tunnel before planting ginger.
- Careful planning and implementation is needed to make the production of high tunnel ginger a success.
- There is a need for a source of reliable and disease free seed-pieces to assure future ginger production in Virginia.

Ginger Field-Day, November 2012. Mr. Charlie Maloney the collaborating grower is explaining ginger production and harvest to the participating growers.

Contact information:
Dr. Reza Rafie
Cooperative Extension
School of Agriculture
Virginia State University
arafie@vsu.edu

Supporting Specialty Crops Through Nutrition Incentives at Central Virginia Farmers Markets

Elizabeth Borst
540-785-7271
Elizabethborst@gmail.com

I. Project Summary

George Washington Regional Commission (GWRC), partnered with The Farmers Market.co (TFM.co), work to increase food access and affordability in the Fredericksburg region to strengthen the local farmers markets network and build producer revenue. This program is designed to offer nutrition incentives, fresh food education and expanded marketing opportunities to benefit Central Virginia specialty crop farmers.

By continuing to build demand from low-income communities for Virginia-grown fruits and vegetables at local farmers markets and by increasing the percentage of federal food dollars that flow to specialty crop farmers, the program provides these farmers with a growing revenue stream that considerably enhances their sustainability.

The overall goal of this program is to provide a 20% increase in revenue for 47 local specialty crop farmers at TFM.co farmers market locations, in order to enhance the competitiveness solely of specialty crops. The program will be implemented at four farmers markets in the Fredericksburg region over six months. The program is to be operated by a Program Leader, an Operations Manager and the local Market Managers, with technical assistance from Wholesome Wave, which assists organizations nationally with successful programming that increases produce purchases at farmers markets. New program elements include expanded market operations and enhanced seasonal fresh food education.

This project builds on a prior Specialty Crop Block Grant (SCBG) that established Supplemental Nutrition Assistance Program (SNAP) Electronic Benefit Transfer (EBT) operations at three farmers markets and provided a $10 Nutrition Incentive to encourage the use of federal benefits for specialty crop purchases. This project continues to build the body of knowledge on how SNAP EBT and Nutrition Incentives at Virginia farmers markets can increase the viability of small and mid-sized family farms and grow the markets for specialty crops. It is timely in light of the federal push to equip more farmers markets with wireless terminals to support EBT access. **In Virginia, the majority of farmers market vendors are Specialty Crop producers, who benefit directly from market token programs that increase fruit and vegetable consumption. Projects demonstrating the impact and benefits of market token programs on Specialty Crop producers can help support further development of such programs to benefit additional Specialty Crop producers.**

II. Project Approach

With the support of this grant, TFM.Co has continued to operate its Market Token Program in the Fredericksburg region for 2013, **directly benefiting 47 Specialty Crop Producers.** Additionally, TFM.Co has been able to undertake several significant local food development projects, including establishing new farmers markets and piloting a Farm-to-Pantry program.

TFM.co is a farmers market network in the Fredericksburg region, working with GWRC (the Planning District Commission for the City of Fredericksburg and the counties of Caroline, King George, Spotsylvania and Stafford) to accomplish these activities. TFM.co partners include the Spotsylvania, Fredericksburg and King George farmers markets.

TFM.co has well-established Market Token and Nutrition Incentive programs, one of four Wholesome Wave partners in Virginia. Going into the fifth season of operation, TFM.co offers centralized credit card and SNAP services through its Market Token Program. The Nutrition Incentive Program provides a $10 weekly bonus to encourage the use of SNAP benefits solely for fresh fruit and vegetable purchases. Credit sales are an important component of these programs to ensure there is no stigma attached to token use, and to increase direct revenue for specialty crop farms. SNAP is the only federal nutrition benefit available for redemption at farmers markets in the Fredericksburg region.

Following is a summary of the Program Workplan and detail on tasks implemented. Additional detail is included in the narrative which follows this section:

Develop program implementation and outreach plans

- **Worked with local markets in the regional network to develop farmers market rack cards and posters. Outreach was targeted to general audiences and SNAP shoppers. Customers appreciated the "market roundup" rack cards which showed locations and times for all regional markets.**
- **Worked closely with Social Services to build outreach to low-income families for TFM.co's Market Token and Nutrition Incentive programs. Designed and produced simplified, market-specific fliers (handouts and posters) and mailers (included in SNAP Notice of Action letters).**

Develop Vegucation Station schedule/staffing plan/survey tools

- **Worked with Virginia Cooperative Extension to develop Vegucation schedule/staffing plan/survey tools to provide seasonal fresh food education at farmers Markets.**
- **Conducted meetings to outline volunteer roles, establish methods and procedures and develop pre- and post survey tools.**
- **Developed survey tools:**

Pre-Vegucation questions: administered by Market Managers prior to Vegucation events

1. How would you describe your familiarity with the wide variety of fresh fruits and vegetables at the Farmer's Market? (1 is least familiar, 5 is most familiar).

2. How would you describe your knowledge of the wellness benefits of fresh fruits and vegetables? (1 is least knowledgeable, 5 is most knowledgeable).

3. About how many different types of fruits and vegetables do you typically buy at the farmers market? 1-2; 3-4; 5-6, 7 or more; It varie

4. How likely are you to buy a new fruit or vegetable today that you have not previously tried? 1 being least likely, 5 being most likely.

5. What prevents you from buying a new fruit or vegetable today? Check the most important.

- Cost;
- My family or I wouldn't eat it;
- I don't know what to do with unfamiliar produce;
- I buy fruits and vegetables elsewhere or grow my own
- Lack of time to prepare;
- It might go to waste
- Other_____

6) How likely would you be to participate in a farmers market program that provided samples, recipes, and tips for produce selection and handling? 1 being least likely, 5 being most likely.

7) How likely would such a program be to increase your likelihood of buying a new produce item? 1 being least likely, 5 being most likely.

Post-Vegucation questions: administered by Vegucation volunteers to Vegucation participants

Questions 1--5 same as above

6) How useful was the Vegucation program that you participated in that provided samples, recipes, and tips for produce selection and handling? 1 being least useful, 5 being most useful

7) How likely are you now to buy a new produce item? 1 being least likely, 5 being most likely.

Begin implementing outreach plans

- **New outreach materials were widely distributed to a broad array of community partners, including Social Services, WIC, Community Health Centers, Food Bank and Pantries, Head Start, YMCA, Thrift Stores, Schools, and Faith-Based Organizations.**
- **Meetings were conducted with Social Services, WIC, Community Health Centers, Food Bank and Pantries, Head Start, YMCA, Schools, and Faith-Based Organizations to provide information about the SNAP and Nutrition Incentive program.**

Regional Market Meeting, training on Incentives provided

- **For the first time, TFM.co hosted a collaborative Regional Producer Meeting that was attended by 70 known producers, as well as 10 new, prospective producers. The meeting highlighted TFM.co programs and results, offered workshops on food safety for producers, and provided application and operational details for each of the five participating markets resulting in a more efficient use of producers' time.**
- **At Regional Producer Meeting and in Market training, producers were trained on Token Program rules and requirements. All producers were made aware of FNS rules on SNAP eligible purchases. Bonus Tokens are designed to increase fruit and vegetable consumption, so only Specialty Crop producers are eligible to accept the incentive tokens. This message was reinforced throughout the season. Producers other than fruit and vegetable growers were not permitted to redeem Bonus tokens for payment.**

Farmers markets launch; ongoing producer training on use of incentives; Incentives monitored and measured.

- **The early season of 2013 was cool and wet, resulting in later availability of popular produce. This uncontrollable variable lead to lower overall sales volume and usage of the Market Token Program. A strong September helped make up for the slow season start.**
- **As new producers entered the markets, or as vendor staff changes occurred, producers received one-on-one token program training.**
- **Incentive use was monitored weekly through Market Token Reports and Producer reimbursement requests. Monthly financial reporting helped maintain program measurement against financial objectives and growth targets.**
- **Program monitoring also occurred though weekly data capture of SNAP and Credit transactions. Information such as zip code, gender, senior, ethnicity, new to market, how learned about market token program is captured and recorded. This information provides a wealth of information about our SNAP customer profile – largely white, female, from nearby zip codes. Social Services, word of mouth, market signage and social media were the predominant channels by which new customers learned about the market token program.**

Vegucation Station implemented and measured

- **Working with partners at Virginia Cooperative Extension Family and Consumer Sciences, Vegucation Station was offered on additional market days to increase awareness and consumption of Virginia-grown specialty crops.**
- **Pre- and post-surveys were implemented to determine the interest in and impact of seasonal fresh food education.**

Incentives ongoing; specialty crop farmers experiencing significant sales; data collected and shared with partners

- **Incentive funding was available for distribution throughout the 2013 market season**
- **SNAP sales increased 13% over 2012**
- **Specialty Crop producers were primary beneficiaries of SNAP purchases at all markets in the network with 67% of SNAP dollars going to fresh fruit and vegetable purchases. (Based on 2012 market season results)**

Vegucation Station evaluated and reported

- **Of 64 pre-surveys completed, 55% indicated they were willing to participate in Vegucation.**
- **36% indicated that they currently purchased three to four different types of vegetables on a typical market visit.**
- **45% indicated that greater knowledge of fresh fruits and vegetables would encourage them to try additional produce varieties.**
- **Overall, customers expressed desire to try new produce items but want to be educated on how to prepare unfamiliar produce.**
- **For the 35 post-surveys completed, consumers indicated that Vegucation was helpful and increased their willingness to purchase additional fresh fruits and vegetables.**
- **80% responded that Vegucation was useful in providing samples, recipes and tips for produce selection and handling.**

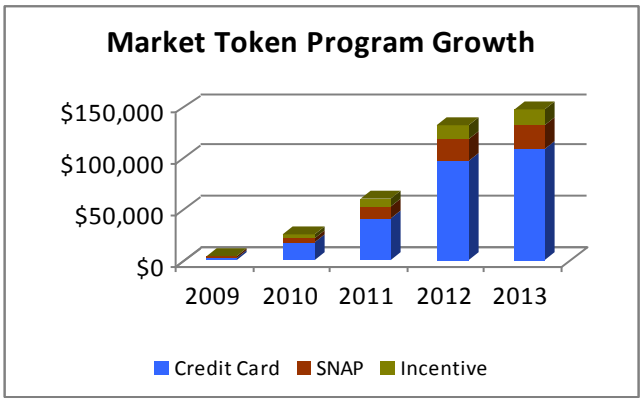
- **77% responded that Vegucation increased their likeliness to buy a new produce item.**

How did project staff ensure that Specialty Crop Block Grant Program funds solely enhanced the competitiveness of specialty crops?

- **Funding for the 2013 Market Token Program came from a variety of sources other than SCBG, including Farmers Market Promotion Program and local Community Benefit Funds.**
- **Project staff time was allocated to these various funding streams to ensure that work paid for by SCBG focused solely on Specialty Crop producers and did not benefit other market sellers.**
- **For example, SCBG helped support the development of a new sales channel (Farm to Pantry) which produced direct income of $20,000 for a Latino-owned mid-sized family farm.**

In 2012 market token sales were $131,097 ($96,735 Credit, $20,542 SNAP, $13,782 Incentive). These program results show a 60% increase over 2011 token sales, creating real impact for family farms in Central Virginia**.**

In 2013, TFM.co farmers markets distributed $147,441 in market tokens. This is a 13% growth over 2012 market token distributions. The chart below shows the growth of TFM.co's Market Token Program since its inception in 2009.



Credit card transactions accounted for 73.6% of market token sales in 2013. There have been 3,271 credit card transactions totaling $108,499. Credit card shoppers spent an average of $33 per market day at TFM.co farmers markets.

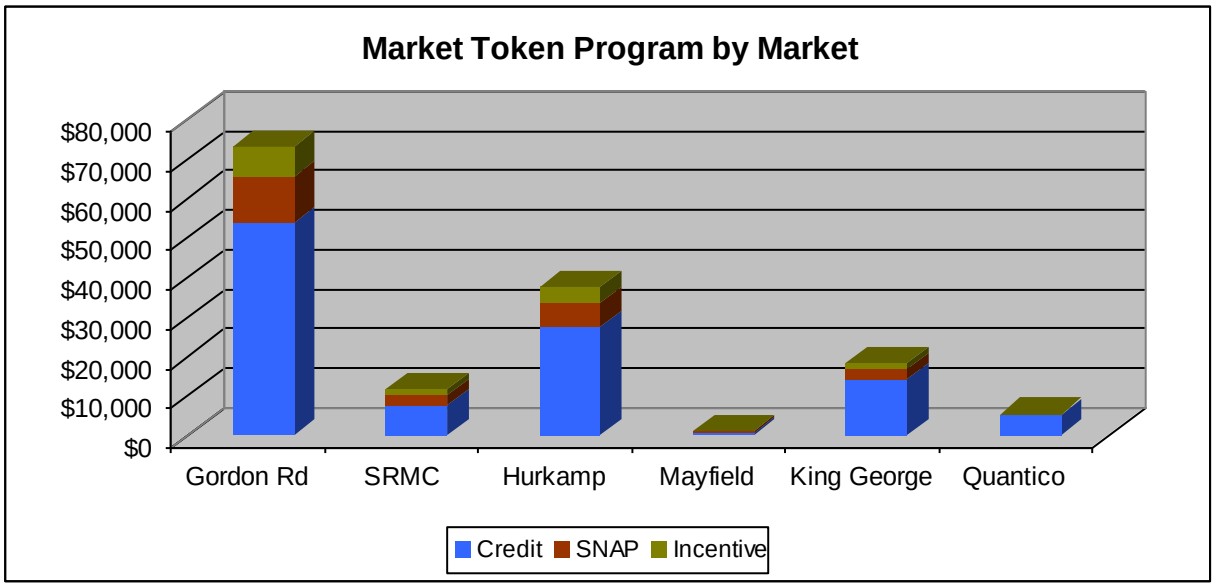
SNAP transactions accounted for 15.6% of market token sales in 2013, while Nutrition Incentives accounted for 10.8%. There have been 1,739 SNAP transactions totaling $23,051. A total of $15,891 in Nutrition Incentives has been distributed in 2013, 94.5% of which were redeemed by producers. For every dollar in Nutrition Incentives distributed, SNAP shoppers used $1.54 of their SNAP benefits. SNAP shoppers spent an average of $22.14 in SNAP benefits and Nutrition Incentives per market day at TFM.co farmers markets.

At the start of 2013, TFM.co's Market Token Program was in operation in 4 farmers markets in the Fredericksburg Region (see the chart below). The Gordon Road market in Spotsylvania County ($73,455 in token sales), the Hurkamp Park market in downtown Fredericksburg ($37,483 in token sales), and the King George County market ($18,293 in token sales) are established farmers markets in operation for many years. The Spotsylvania Regional Medical

Center (SRMC) market, also in Spotsylvania County, was opened in 2012 and had token sales of $11,846 in 2013. This market experienced a 'sophomore slump' in credit card sales ($12,946 in 2012 vs. $7,620 in 2013); however SNAP sales grew slightly ($2,403 in 2012 vs. $2,479 in 2013).

During the 2013 market season, TFM.co also opened two new markets. As a part of the Department of Defense Healthy Base Initiative, a farmers market was established on the Marine Corps Base Quantico. The market opened with 4 producers in August and ran for 9 weeks. The Quantico market was the first TFM.co market to operate on a sales-percentage basis, providing important insights into sales trends. Total market sales at Quantico were $32,638 with $5,306 of that in token sales. Less than $50 in SNAP transactions were enacted at the Quantico farmers market.

The second new farmers market was opened in the Mayfield area of Fredericksburg, a historic low-income neighborhood. The Mayfield market also opened in August with 1 producer. It ran for 13 weeks with market token sales totaling $1,068, $347 of which was SNAP.



In addition to establishing new TFM.co farmers markets, TFM.co mentored a volunteer Market Manager as she opened the North Stafford Farmers Market in 2013. TFM.co provided advice on location, rules, operations and processes for the new market, as well as informing TFM.co producers of the new sales opportunity. TFM.co facilitated the location of the North Stafford Farmers Market at a regional hospital, and colloborated on a hospital foundation grant opportunity to add SNAP EBT operations in 2014.

In 2013, TFM.co also began working with St. George's Episcopal Church in Fredericksburg to pilot the provisioning of fresh local produce to St. George's innovative emergency food pantry, The Table. This pilot program links low-income families with healthy food grown on a specialty crop family farm. The Table is a "farmers market" style food pantry operation with patrons self-selecting from a wide array of healthy food choices. The Table focuses on fresh food

distribution, is staffed mainly by volunteer recipients, and serves a diverse population. *Their focus on fresh fruit and vegetable distribution is an innovative and healthy approach to emergency* food *provision. For this pilot, St. George's has been buying about 2,000 pounds a month in specialty crops directly from a Northern Neck Latino producer. TFM.co has brokered the wholesale purchase and delivery of vegetable seconds each week from April to November, with a small percentage going to support TFM.co staff time and the Nutrition Incentive Program. The Farm-to-Pantry pilot* has provided important lessons upon which to build a more robust community Farm-to-Pantry Program in 2014, benefiting *additional specialty crop producers.*

III. Goals and Outcomes Achieved

The following set of activities was accomplished in performance of this project.

- Supported new specialty crop producers becoming market sellers and participating in TFM.co's Market Token and Nutrition Incentive program resulting in increased direct sales revenue. For the first time, TFM.co hosted a Regional Producer Meeting that was attended by 70 known producers, as well as 10 new, prospective producers. The meeting highlighted TFM.co programs and results, offered workshops on food safety for producers, and provided application and operational details for each of the five participating markets resulting in a more efficient use of producers' time.
- Continued to operate the Market Token and Nutrition Incentive programs at all TFM.co farmers markets. Opened two new SNAP EBT-enabled markets in the neighboring communities of Quantico and Mayfield.
- Worked closely with Social Services to build outreach to low-income families for TFM.co's Market Token and Nutrition Incentive programs. Designed and produced simplified, market-specific fliers (handouts and posters) and mailers (included in SNAP Notice of Action letters). New outreach materials were widely distributed to a broad array of community partners, including Social Services, WIC, Community Health Centers, Food Bank and Pantries, YMCA, Thrift Stores, Schools, and Faith-Based Organizations.
- In conjunction with Virginia Cooperative Extension, offered Vegucation Station on additional market days to increase awareness and consumption of Virginia-grown specialty crops.
- Built stronger statewide food system alliances by helping to develop the Virginia Farmers Market Managers Association (VFMMA). TFM.co market managers spoke on food safety, SNAP EBT/Nutrition Incentives, Vegucation and Farm-to-School programs at the VFMMA "Building Better Markets Through Better Managers" conference, as well as served as mentors for the New Market Managers Clinic.

The primary goal of this project was to provide a 20% increase in market token sales for specialty crop producers participating in TFM.co farmers market over their sales of 2012. Market token sales actually increased by 13% at TFM.co markets in 2013. We think at least two factors contributed to not achieving the target goal. First, the goal target was based on the growth of the Market Token Program in the previous years. The Market Token Program was in its early stages and experienced exponential growth in those years. As it is not possible to maintain exponential growth as a program matures, it would have been more realistic to set a goal in the 10-15% range, which is what was attained. Another factor was the nature of the 2013 growing season. There was an extended and cold spring followed by a wetter-than-usual summer, which slowed

sales at TFM.co markets. While there were stronger than usual fall sales, this did not sufficiently offset the slow start.

A second project goal was to provide seasonal fresh fruit and vegetable education through Vegucation Station at four markets on additional market days. Working through program partner Virginia Cooperative Extension family and Consumer Sciences, this goal was achieved, with some modification based on availability of staff and volunteers. Fielding frequent, volunteer-lead seasonal fresh food education events proved be challenging but a workable format was arrived at after some trial and error.

Consumers responded well to the program, whose goal was to provide market shoppers with targeted education on identification, selection, preparation and storage of Virginia Grown fruits and vegetables through tastings, tips and recipes. The plan to provide on line surveys was revised in favor of more immediate at market surveys to measure the impact of the information on their familiarity with and/or intent to buy specialty crops. In pre-surveys, participants showed a strong interest in learning about fresh food identification, selection, preparation and storage. In post-surveys, they largely indicated that the Vegucation Station program was helpful and increased their willingness to purchase additional fresh fruits and vegetables.

- **Of 64 pre-surveys completed, 55% indicated they were willing to participate in Vegucation.**
- **36% indicated that they currently purchased three to four different types of vegetables on a typical market visit.**
- **45% indicated that greater knowledge of fresh fruits and vegetables would encourage them to try additional produce varieties.**
- **Overall, customers expressed desire to try new produce items but want to be educated on how to prepare unfamiliar produce.**
- **For the 35 post-surveys completed, consumers indicated that Vegucation was helpful and increased their willingness to purchase additional fresh fruits and vegetables.**
- **80% responded that Vegucation was useful in providing samples, recipes and tips for produce selection and handling.**
- **77% responded that Vegucation increased their likeliness to buy a new produce item.**

The goal was to offer Vegucation twice monthly at four markets in 2013. Programming was actually delivered 9 times over the market season. One market in the initial plan was swapped for another market in the region when weekday daytime volunteers were unavailable. In total over 4500 area farmers market shoppers were exposed to Vegucation tastings, tips and recipes (minimum of 500 shoppers per event).

IV. Beneficiaries

Both Specialty Crop farmers and consumers benefited from TFM.co's Market Token Program. Forty-five (45) specialty crop farmers increased sales by an average of 13% through the Market Token Program as a result of this grant. SNAP consumers utilized the Market Token program 1,739 times, spending $23,051 in SNAP benefits at TFM.co farmers markets. Credit card consumers conducted 3,271 transactions, valued at $108,499. Combined with $15,891 in Nutrition Incentives, these sales provided increased revenue and viability for family farms participating in regional farmers markets. SNAP shoppers reported that Nutrition Incentives increased their consumption of a variety of fresh fruits and vegetables. Many SNAP shoppers

came from surrounding counties, affirming the need for SNAP EBT to be available at more farmers markets to meet the growing demand for fresh food.

V. Lessons Learned

The following are the lessons learned by the project staff as a result of completing this project.

- Specialty crop producers reap significant benefits from market token programs through the access to a new customer base and through additional sales revenue.
- Increasing low-income families access to fresh foods through SNAP EBT and Nutrition Incentives at farmers markets is a viable strategy to build local and regional food systems. Direct support of other federal benefit programs (e.g., WIC and Senior Farmers Market Nutrition programs) at farmers markets would allow local food organizations to fully leverage this specialty crop growth opportunity.
- Regional farmers market networks are an effective approach to administering market token programs. Small independent markets can collaborate and cooperate for increased efficiencies and effectiveness with outreach, producer training, fiscal management, data collection and reporting activities.
- Operating a market token program is complex and staff intensive, requiring that local foods organizations be well-staffed and adequately funded to undertake such low income access programs.
- Continual outreach is required to reach federal benefit recipients with the message that they can use SNAP EBT at farmers markets. This places new requirements on farmers market staff, who may lack capacity to undertake this level of community outreach.
- Partnerships are particularly important in promoting access and affordability of fresh foods through market token programs. Community partners who have frequent and direct contact with low-income residents, such as Social Services and Community Health, must be engaged as agents for program success.
- Program susainability is a key issue facing local food organizations that operate market token programs. A statewide network that provides common program design, branding and technical assistance for markets wishing to establish market token programs in Virginia would benefit estabished and new programs. In additon, such a network could provide a backbone for funding resources and help develop "regional local food champions" that can support market token program development thoughout the state.

An unexpected result of this project is how much of a catalyst for further development of local food initiatives that operating market token and nutrition incentive programs provides. Primarily because of TFM.co's successful Market Token and Nutrition Incentives programs, we have been involved in the opening of four new farmers markets in Planning District 16, as well as piloting an innovative Farm-to-Pantry program, all of which directly benefit specialty crop farmers. Direct seed funding of market token programs can speed the evolution of the regional food system in many communities.

VI. Additional Information

Contact: Elizabeth Borst, Program Leader
elizabethborst@gmail.com
540-785-7271 (home), 540-845-4267 (cell)
The Farmers Market.co

Large Scale Carrot Evaluations
Virginia Tech
Mark Reiter

The approved state plan for Specialty Crop Block Grant #12-25-B-1101 included a project entitled "Stink Bug populations, Injury and Control on Primocane-bearing Caneberries" which came in significantly under budget, leaving a balance of $13,241.28. $12,800 of the remaining funds were allocated towards the following project

I. Project Summary

Vegetables and other specialty crops often offer significant profit potential for producers. Unfortunately, growers must establish a market for these products; which is often the most difficult task. Recent increases in fuel prices have added significantly to the overall production costs of many vegetable crops. In the case of high value crops, higher fuel costs can be absorbed, but in lower value crops higher costs can significantly impact production decisions. Therefore, high fuel costs now offer Virginia producers an opportunity for an alternative crop. A carrot producer/packer is seeking product from Virginia producers to increase their supply in order to expand market opportunities. Carrots offer a significant economic opportunity to local producers, but this crop has not been produced on the Eastern Shore of Virginia for many years. Small plot research trials conducted at the Virginia Tech Eastern Shore AREC (ESAREC) indicated high yield potentials in 2012, but a large field scale project that is mechanically harvested and graded is necessary to determine true commercial viability.

The goal of this project was to determine if carrots could be produced successfully on a commercial scale by a farmer on the Eastern Shore of Virginia. The Eastern Shore's soils and climate vary from other major carrot producing areas. If acceptable carrots are produced, a new crop for Virginia farmers may be possible. Producing more foods closer to large metropolitan areas will assist with shipping costs, produce freshness, and overall sustainability of the fresh market system. The potential of a carrot industry in Virginia would offer an economic benefit to producers involved. The profit potential would be higher than nearly any other vegetable or grain crop that is currently produced here. It is unclear what the maximum potential carrot acreage is so the total economic impact to the agricultural economy is unclear, but it stands to increase the net profitability of the producers involved. If carrot acreage is established, a reasonable mature industry may be 300 acres; which would likely support ten to fifteen individual producers. This project was not funded by any other granting agency and was new to the SCGBP.

II. Project Approach

Five acres of multiple carrot varieties were planted with a local farmer on the Eastern Shore of Virginia on April 3, 2013. The soil was classified as a Bojac fine sandy loam; which is a representative soil series for the Eastern Shore of Virginia. Published soil characteristics include a cation exchange capacity of 4.2 meq/100 grams soil, 1.25% organic matter, 5.5% clay, 60.2% sand, 34.3% silt, more than 78 inches to a restrictive layer, and 60 inches to the average water table. The soil was chisel plowed and ripped to a depth of 18 inches. Beds were established with an offset disc-bedder. Beds were tilled with a rotary tiller and then planted. Carrot varieties planted were: CR2289, Envy, Trooper, and Rebel. Lorox herbicide was applied pre-emerge at a

rate of 1.5 lb/acre. A subsequent post-emerge application of Lorox was made at a rate of 1.0 lb/acre (April 11, 2013). On May 28, 12 oz./acre of Intensity and ¾ quart/acre of LI700 was applied. The crop was established and maintained by the cooperating farmer. Fertilizer was applied based on Mehlich-1 soil tests from Virginia Tech and a yield goal of 50,000 lbs. carrots/acre. The fertilizer protocol is presented in Table 1. Tissue tests were conducted during the growing season and our fertilizer protocol produced tissue test results within acceptable ranges for all nutrients (Fig. 1). Virginia Tech Eastern Shore AREC staff harvested several small plots within the field at maturity and determined potential marketability of the crop (See pictures). Overall, Rebel seemed to produce the straightest carrots that would be best for grading (see pictures). The quality of the crop appeared acceptable; therefore, Hillside Gardens LLC transported their carrot combine to Virginia and harvested the trial. Hillside Garden's Georgia facility washed, graded, and packaged the harvested carrots.

After washing, grading, and packaging, the total marketable carrot yield was 126 cases of 48 bags that contained 1 lb. of carrots = 6,048 lbs. and 20,830 lbs. of 2-inch cuts. This is a total yield for the 5 acre harvest area of 26,878 lbs.; which is only 5,376 lbs./acre = 18% of desired yield of 30,000 lbs./acre. Overall, this is a very poor yield and not cost effective. The marketable yield was so low due to undersized carrots and cull carrots (split or crooked). There are several problems that may have impacted overall carrot yields. Primarily, the carrots were planted about 1 month past their desired plant date. A 1-month delay meant that carrots were "bulking" during excessive heat and would no longer gain size. Carrots generally grow more aggressively between temperatures of 40 and 80°F. Therefore, planting in early April versus early March deleted approximately 40 days from the carrot growing season when temperatures were below the desired 80°F (Fig. 2). Temperature stress was observed during high daily temperatures with wilted carrot tops being common. Above optimal growing temperatures also leads to rapid growth which increases the number of split carrots which are unmarketable. A timely planting may increase yields and should be tested further; which will vary by year.

III. Goals and Outcomes Achieved

Overall, the project proceeded as expected and pack-out yield results were achieved. Our actual yields were only 18% of target yields; therefore, more work needs to be completed for the carrot production system in Virginia's climate prior to large scale plantings. Further variety testing, planting date studies, and agronomic programs (nutrient, weed, disease, and insect) need to be evaluated as well as cultural (such as tillage) protocols. Based on these low yielding pack-outs, we are not ready to go full scale production and commercialization in Virginia. Therefore, it is unlikely that we will reach our 2-3 year benchmark of 100 acres in Virginia. However, we did accomplish considerable exposure and interest in carrot production through this large-scale demonstration project. Information was shared at the Eastern Shore Ag Conference and Trade Show and producers (80 farmers, government employees, and other stakeholders were in attendance during day two's vegetable session) were optimistic and interested in learning more about the possible new carrot industry. Information learned from this project is currently being captured into Virginia Cooperative Extension's information dissemination system that includes a publication (being written and will be housed on the VCE server), on social media (pictures and data are posted on the Eastern Shore AREC Department of Crop and Soil Environmental Sciences's Facebook page), and via first-hand education/training by having two Extension

Specialists and two Virginia Cooperative Extension agents involved in the research and demonstration.

IV. Beneficiaries

Virginia farmers' benefited from this research because we learned valuable insights into the production of full scale carrots in Virginia using modern varieties and production systems. We believe that the carrot market is obtainable and sufficient yields with quality carrots can be produced with further research trials. With Virginia's Mid-Atlantic climate, farmers in this location can certainly fill a "hole" in carrot production that occurs between the Deep South (GA) and northern (Canada) harvests. Carrots offer substantial profit potential over most other traditional grain and fiber crops. Net profits that could be expected from successful carrot production are between $1,500 and $3,000 per acre. If carrot acreage could be established and grow to what may be a mature market of 300 acres, it would likely benefit 10-15 individual farming operations.

V. Lessons Learned

Weather is always an issue as far as agriculture research is concerned. A wet spring did not allow timely planting of carrots; which are difficult to plant due to the small seed size. Soil must be the appropriate moisture to ensure a smooth seed bed for optimal seed spacing and germination. With further research, we feel that the carrot industry is a viable enterprise on Virginia's Eastern Shore.

VI. Additional Information

See pictures below for each variety. These pictures were taken near harvest.

Mark Reiter
mreiter@vt.edu
(757) 414-0724

Table 1. Mehlich-1 soil test concentrations, levels, and recommendations for a field scale carrot evaluation on the Eastern Shore of Virginia utilizing sandy loam soils in 2013.

Nutrient	Soil Testing Concentration	Soil Testing Level	At-Planting	Split #1	Split #2
			----------lbs./acre----------		
Nitrogen	---	---	40	20	20
Phosphorus	291 lb./A	VH	0	0	0
Potassium	108 lb./A	M	80	80	0
Magnesium	94 lb./A	M-	40	0	0
Calcium	798 lb./A	M-	85	0	0
Boron	0.2 ppm	Sufficient	3	0.25	0
Lime	6.28 BpH	Low	2000	0	0

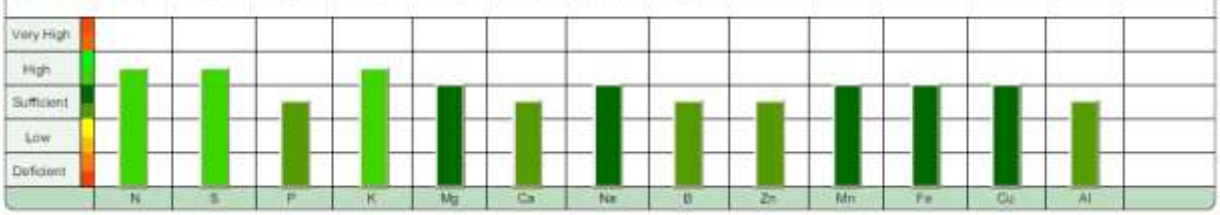
Fig. 1. Carrot top tissue tests during the growing season following a fertilizer regime presented in Table 1.

Submitted By: **MARK REITER**
Crop : **Carrot***
Growth Stage : **Mid-season**

Field id:
Sample Id : **STURGIS CARROTS**

	Nitrogen %	Sulfur %	Phosphorus %	Potassium %	Magnesium %	Calcium %	Sodium %	Boron ppm	Zinc ppm	Manganese ppm	Iron ppm	Copper ppm	Aluminum ppm
Analysis	3.54	0.52	0.31	4.09	0.49	1.58	0.17	45	42	193	210	14	79
Normal Range	2.10 3.51	0.30 0.51	0.20 0.51	2.80 4.01	0.30 0.51	1.40 3.01	0.00 0.21	30 101	25 251	60 201	50 301	6 16	0 251

	N/S	N/K	P/S	P/Zn	K/Mg	K/Mn	Ca/B	Fe/Mn
Actual Ratio	6.8	0.9	0.6	73.8	8.3	211.9	351.1	1.1
Expected Ratio	6.9	0.8	0.9	25.7	8.4	260.9	336.6	1.3



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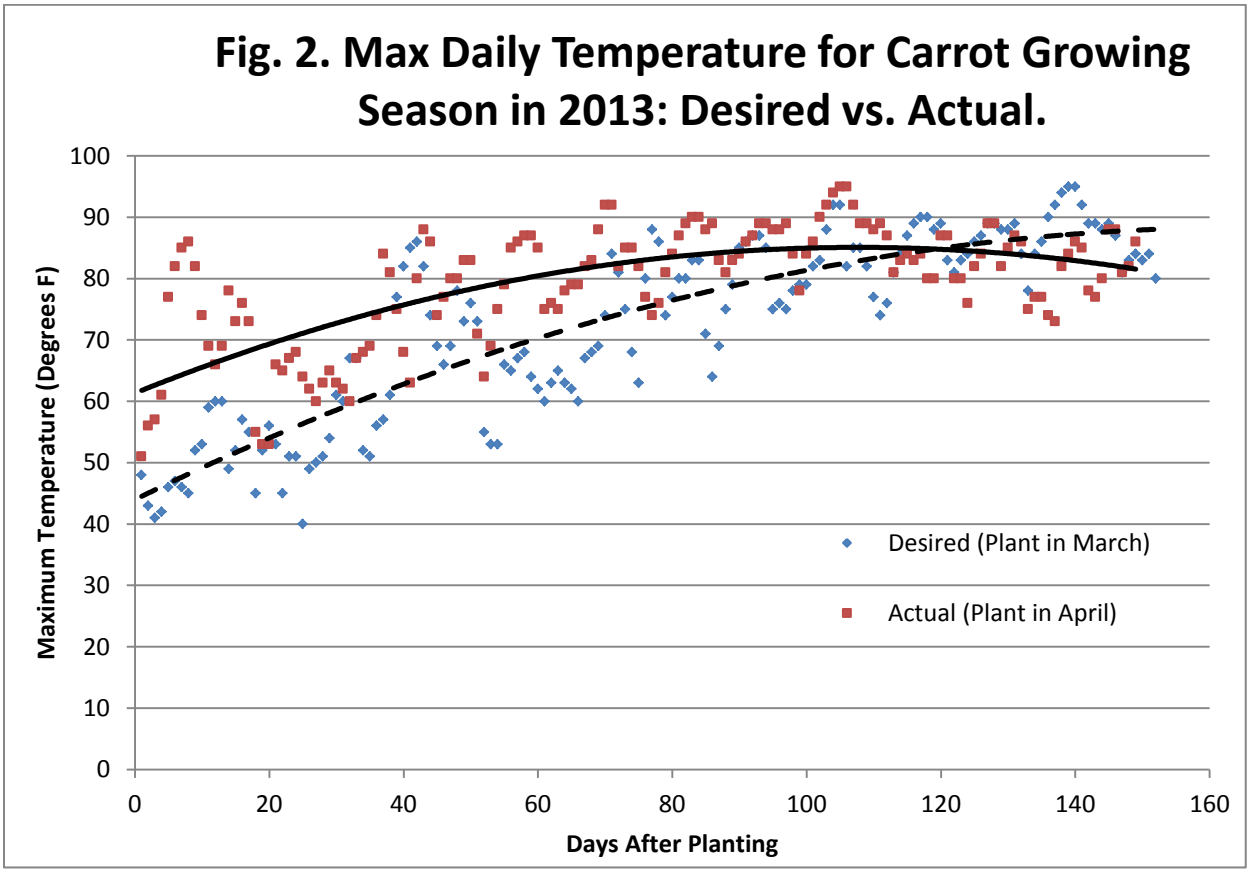

Rebel

RESULTS OF THE 2011 VIRGINIA FARM TO SCHOOL PROGRAM SURVEY OF SCHOOL NUTRITION DIRECTORS

OCTOBER 2012
(Updated from February 2012)

By the Virginia Tech Department of Agricultural and Extension Education in partnership with the Virginia Department of Education and Virginia Department of Agriculture and Consumer Services

Research funded through a 2010 Virginia Specialty Crop Block Grant.

Contact Information

For more information about the project, please contact the project directors.

- Matt Benson, PhD Candidate, Department of Agricultural & Extension Education, Virginia Tech, Phone: (540) 522-0762, Email: mcbenson@vt.edu

- Kim Niewolny, PhD, Assistant Professor, Department of Agricultural & Extension Education, Virginia Tech, Phone: (540) 231-5784, Email: niewolny@vt.edu

Executive Summary

During the fall of 2011, a statewide survey of Virginia school nutrition directors was completed to explore their interest, knowledge, and participation in the Virginia Farm to School Program. The survey was designed in three sections. Section one asked school nutrition directors about their attitudes and opinions of the strengths, weaknesses, opportunities, and barriers of Farm to School and purchasing local or regional foods. Section two asked school nutrition directors for information about their school lunch program. Section three asked school nutrition directors a series of demographic questions about individual and community characteristics. In total, 85 responses were received from Virginia school nutrition directors for a response rate of approximately 62 percent. All of the respondents were at least generally familiar with the Virginia Farm to School Program. Respondents primarily classified local food as food raised or produced within Virginia. When asked what steps they had taken to include local foods in their school division, the number one response was served meals featuring local foods. Respondents stated they most strongly agreed with the statement that purchasing local food increases support of Virginia farms and/or businesses and that schools support their local economy and local community by purchasing local foods. When asked about the potential problems of purchasing local foods, respondents most strongly agreed with the statement that the seasonal availability of local foods was a potential problem. When asked about what would make them more likely to purchase and use local foods, respondents stated that they most strongly agreed with the statement that they would purchase and use more local foods if local foods were available from the company which they normally purchase foods from. When asked about how helpful it would be to have additional information about purchasing local foods, the statement respondents most strongly agreed with was that it would be helpful if they had a list of local suppliers and food products from local sources. Respondents stated they were most familiar with Virginia Cooperative Extension when asked which organizations, programs, or initiatives they were familiar with. The majority of respondents stated they participated in the 2009 and 2010 Virginia Farm to School Week. When asked about which activities would be beneficial to help them participate in Virginia Farm to School Week or National Farm to School Month, respondents stated the best activity that could be completed was to help them find, promote, and connect to local farmers. The majority of respondents stated their contracts with either a primary or secondary food vendor does not limit their ability to purchase local foods. Responses from the survey helped inform Virginia Farm to School stakeholders about the depth of Farm to School efforts in Virginia. Responses will be used to help complete follow-up focus groups and interviews with school nutrition directors, specialty crop farmers, and food distributors.

Introduction & Background

The Virginia Farm to School Program is an effort to increase the amount of fresh and nutritious Virginia Grown products offered in schools and to promote opportunities for schools and local farmers to work together (Virginia Department of Agriculture and Consumer Services, 2012). The Virginia Farm to School Program officially began through legislation passed in 2007, Senate Joint Resolution 347 (2007), which requested for the Virginia Secretary of Agriculture and Forestry and the Secretary of Education to establish a Farm to School Task Force charged with developing a plan for implementing Farm to School in Virginia. The task force met and identified a number of challenges to Farm to School in Virginia, including product availability, distribution, product costs, food safety, labor, and education. To address these challenges, the task force developed four recommendations which were: 1) to strengthen the partnership between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Education, 2) design a VDACS Farm to School website to include sections for farmers, distributors, and educational institutions, 3) identify funding sources for certification assistance in Good Agricultural Practices, and 4) conduct a pilot study (Virginia Farm to School Task Force Report). Since 2009, Virginia has held a Farm to School Week every year. In 2010, the Virginia General Assembly passed House Joint Resolution 95 (2010), which officially declared the second week of November as Virginia Farm to School Week. In October of 2010, the Department of Agricultural and Extension Education at Virginia Tech was awarded a Virginia Specialty Crop Grant to complete a statewide mixed methods evaluation of the Virginia Farm to School Program. As part of this project, Virginia Tech was tasked with completing a survey of Virginia's local school nutrition directors to better understand their attitudes, knowledge, and behaviors towards the Virginia Farm to School Program.

Applied Research Methods

The Virginia Farm to School Program survey development process started at the end of 2010 with a thorough scan of the literature to compile a complete list of Farm to School surveys of school nutrition directors used in other states. Instruments were found from ten other states including Alaska, Colorado, Delaware, Michigan, Minnesota, Missouri, North Carolina, New York, Oklahoma, and Pennsylvania. Project directors reviewed the existing survey instruments and decided to model the Virginia survey after the Pennsylvania instrument. During the winter of 2011, project directors met with the Virginia Farm to School Work Group whose membership includes representation from the Virginia Department of Education, Virginia Department of Agriculture and Consumer Services, Virginia Farm Bureau Agriculture in the Classroom Program, and Virginia Food System Council to gain input from key Farm to School stakeholders. During the summer of 2011, project directors meet individually with representatives from the Virginia Department of Education and Virginia Department of Agriculture and Consumer Services to gain additional input regarding the survey instrument. The Virginia Department of Education advised project directors to complete an online instrument for ease of distribution and computation of results. Once the instrument was uploaded online, seven key Farm to School stakeholders were asked to review the survey. A few minor revisions were made to the instrument and the online instrument was finalized. The Virginia Tech Institutional Review Board reviewed and approved the survey instrument (IRB Number 10-1093).

The survey was designed into three sections. Section one asked school nutrition directors for attitudes and opinions of strengths, weaknesses, opportunities, and barriers of Farm to School and purchasing local or regional foods. Section two asked school nutrition directors for information about their school lunch program, as well which local foods they are currently purchasing. Section three asked school nutrition directors a series

of demographic questions including how they would like to follow-up and connect further with more Virginia farmers. The Virginia Department of Education Director of School Nutrition agreed to work as a liaison between the project directors and local school nutrition directors during the survey implementation process. On October 18, 2011, the Virginia Department of Education sent the survey invitation to 138 local school nutrition directors inviting them to complete the survey. On November 1, 2011 and November 17, 2011 follow-up reminders were sent by the Virginia Department of Education to each local school nutrition director who had not completed the survey. In total, 85 school nutrition directors completed the survey for a response rate of 61.6% (85 out of 138).

Results

In total, 85 responses were received from local Virginia school nutrition directors. Table 1 summarizes the responses and lists each district that responded to the survey. Respondent's specific position title varied, however; all of the titles referenced being an administrator, director, or supervisor of the local school nutrition program.

Table 1. Respondents school division name (n=85)

Name of School Division	Fluvanna County	Portsmouth City
Accomack County	Franklin City	Powhatan County
Alexandria City	Gloucester County	Prince Edward County
Alleghany County	Goochland County	Prince George County
Amelia County	Halifax County	Prince William County
Amherst County	Hampton City	Pulaski County
Appomattox County	Harrisonburg City	Radford City
Bedford County	Henrico County	Rappahannock County
Bristol City	Henry County	Richmond County
Buchanan County	Highland County	Rockbridge County
Buckingham County	Hopewell City	Rockingham County
Campbell County	Isle of Wight County	Salem City
Caroline County	King William County	Shenandoah County
Carroll County	Lancaster County	Smyth County
Charles City County	Louisa County	Southampton County
Charlotte County	Madison County	Stafford County
Chesapeake City	Manassas City	Staunton City
Chesterfield County	Martinsville City	Suffolk County
Clarke County	Middlesex County	Surry County
Colonial Beach City	Montgomery County	Tazewell County
Craig County	Nelson County	Virginia Beach City
Culpeper County	New Kent County	VTCC
Cumberland County	Norfolk City	Warren County
Danville City	Northampton County	Washington County
Dickenson County	Northumberland County	Waynesboro City
Dinwiddie County	Nottoway County	Williamsburg-James City County
Fairfax County	Patrick County	Winchester City
Falls Church City	Pittsylvania County	York County
Floyd County	Poquoson City	

When asked how familiar they were regarding the Virginia Farm to School Program, the majority of school nutrition directors stated they were very knowledgeable of the Virginia Farm to School Program (55.3%). None of the respondents (0%) stated that they had never heard of the Virginia Farm to School Program (Table 2).

Table 2. Familiarity with the Virginia Farm to School Program (n=85)

	Percentage of Response	Number of Responses
Very knowledgeable of the Virginia Farm to School Program.	55.3%	47
Have heard of the Virginia Farm to School Program, but do not really know what it involves.	44.7%	38
Never heard of the Virginia Farm to School Program.	0.0%	0

When asked how they define "local food" for their school nutrition program, approximately one half of all respondents (50.6%) stated they classify local food as food raised or produced within Virginia (Table 3).

Table 3. Definition of local food for school nutrition program (n=85)

	Percentage of Response	Number of Responses
Food raised or produced within Virginia	50.6	43
Food raised or produced within my county or city	15.3	13
Food raised or produced within 50 miles of my school division	14.1	12
Food raised or produced within 100 miles of my school division	11.8	10
Food where I know the producer or the conditions under which it was produced	4.7%	4
Food provided by small or medium sized farms and food businesses	2.4%	2
Not sure / do not know	1.2%	1

When asked what steps they had taken to include local food in their school division, the number one response was served meals featuring local foods (86.3%). The second highest response was procured local food using 'geographic preference (46.6%). The third highest response was developed purchasing relations with local farmers (44.9%). Very few respondents (3.0%) stated they had held a student-led market featuring local produce or held a farmer's market at a school (7.5%) (Table 4).

Table 4. Activities taken to include local food in schools (n=85)

	Yes	No	I plan to in the next 12 months.
Served meals featuring local foods.	86.3%	6.3%	7.5%
Procured local food using 'geographic preference'.	46.6%	46.6%	6.8%
Developed purchasing relations with local farmers.	44.9%	39.7%	15.4%
Invited a farmer to a school to support education about local food and agriculture.	40.3%	50.0%	9.7%
Planted a school garden.	36.0%	52.0%	12.0%

Worked with teachers to include classroom-based curriculum featuring local foods and agriculture.	31.9%	59.7%	8.3%
Served local food from a school garden.	29.3%	60.0%	10.7%
Took students to visit a farm or other farm-related field trip.	18.8%	75.4%	5.8%
Held a farmer's market at a school.	7.5%	86.6%	6.0%
Held a student-led market featuring local produce.	3.0%	90.9%	6.1%

The majority of respondents stated they most strongly agreed that purchasing local food increases support of Virginia farms and/or businesses (63.1%). The second statement respondents most strongly agreed with was that schools support their local economy and local community by purchasing local foods (57.1%).The third statement respondents most strongly agreed with was that purchasing local food enhances school division public relations (48.8%). Very few respondents (9.6%) strongly agreed with the statement that a potential benefit of Farm to School is that student rates of obesity and overweight may be reduced and that transportation costs associated with purchasing local food are lower. Lastly, very few respondents (10.7%) strongly agreed with the statement that students have healthier diets when schools purchase and serve local foods (Table 5).

Table 5. Potential benefits of Farm to School Program (n=85)

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
Purchasing local food increases support of Virginia farms and/or businesses.	3.6%	1.2%	32.1%	63.1%
Schools support their local economy and local community by purchasing local foods.	6.0%	2.4%	34.5%	57.1%
Purchasing local food enhances school division public relations.	3.6%	2.4%	45.2%	48.8%
Purchasing local food helps preserve farmland.	4.8%	7.1%	41.7%	46.4%
Schools know more about the sources of local foods.	6.0%	19.0%	53.6%	21.4%
Students enjoy tastier meals when schools purchase and serve local food.	10.7%	25.0%	51.2%	13.1%
Students have healthier diets when schools purchase and serve local foods.	10.7%	27.4%	51.2%	10.7%
Student rates of obesity and overweight may be reduced.	16.9%	33.7%	39.8%	9.6%
Transportation costs associated with purchasing local food are lower.	14.5%	34.9%	41.0%	9.6%

When asked about the potential problems of purchasing local foods, very few respondents (1.2%) strongly agreed with the statement that local foods do not match student tastes and food preferences. Additionally, very few respondents stated that they strongly agreed with the statement that purchasing local foods might threaten the relationship with my usual vendor(s) (1.2%) or that language in the food service contract prevents or limits purchasing of local foods (2.5%). Furthermore, very few respondents stated they strongly agreed with the statement that a potential problem for Farm to School is that local foods have little

or no support from others in the school division (7.2%) or that a potential problem for Farm to School is payment procedures for local foods (8.8%) (Table 6).

Table 6. Potential problems of Farm to School Program (n=85)

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
The seasonal availability of local foods.	4.9%	7.3%	36.6%	51.2%
Delivery issues with local foods.	6.2%	23.5%	35.8%	34.6%
The inadequate supply of local foods.	3.7%	9.8%	56.1%	30.5%
Ordering procedures for local foods.	6.3%	25.0%	55.0%	13.8%
Local foods cost too much.	7.2%	33.7%	47.0%	12.0%
Payment procedures for local foods.	7.5%	37.5%	46.3%	8.8%
Local foods have little or no support from others in the school division.	18.1%	42.2%	32.5%	7.2%
Language in the food service contract that prevents or limits purchasing of local foods.	30.0%	42.5%	25.0%	2.5%
Local foods do not match student tastes and food preferences.	32.9%	50.0%	15.9%	1.2%
Purchasing local foods might threaten the relationship with my usual vendor(s).	36.6%	43.9%	18.3%	1.2%

When asked about what would make them more likely to purchase and use local foods, the majority of respondents stated that they most strongly agreed with the statement if local food was available from the company who I normally purchase from (61.3%). The statement the second most number of respondents strongly agreed with is they would be more likely to purchase and use local foods in their division if there was one place for ordering local foods from multiple farmers (54.4%). The statement that the third most number of respondents strongly agreed with is they would be more likely to purchase and use local foods in their division if there were more local producers in the area from whom to purchase (49.4%). Very few respondents strongly agreed with the statement that they would be more likely to purchase and use local foods in their division if local foods were also certified organic (6.3%) (Table 7).

Table 7. Likelihood of purchasing and serving more local foods (n=85)

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
...local food was available from the company who I normally purchase from.	2.5%	3.8%	32.5%	61.3%
...there was one place for ordering local foods from multiple farmers.	3.8%	3.8%	38.0%	54.4%
...there were more local producers in the area from whom to purchase.	3.8%	8.9%	38.0%	49.4%
...local foods were more available.	2.5%	7.6%	43.0%	46.8%
...local farmers contacted me to show me their products.	6.3%	15.0%	42.5%	36.3%

...educational curriculum included instruction and teaching about local foods and agriculture.	4.1%	16.2%	47.3%	32.4%
...local foods were comparable in cost to other foods purchased.	9.0%	34.6%	28.2%	28.2%
...canned or frozen local food products were more available.	7.6%	19.0%	49.4%	24.1%
...there was more interest from parents or community members.	5.3%	23.7%	48.7%	22.4%
...partially processed local products were more available (e.g. pre-packaged apple slices vs. whole apples).	7.7%	26.9%	43.6%	21.8%
...I had additional school nutrition staff.	9.0%	38.5%	30.8%	21.8%
...there was more interest from students.	5.2%	28.6%	45.5%	20.8%
...there were access to programs to help school nutrition staff learn needed culinary skills.	4.0%	32.%	45.3%	18.7%
...there was more support from school division administration.	10.5%	31.6%	39.5%	18.4%
...local foods were comparable in quality to other foods purchased.	5.1%	24.1%	53.2%	17.7%
...I had additional or different food preparation facilities and/or equipment.	14.3%	49.4%	22.1%	14.3%
...local foods were also certified organic.	22.8%	44.3%	26.6%	6.3%

When asked about how helpful it would be to have additional information about purchasing local foods, the number one statement respondents strongly agreed with was that it would be helpful if they had a list of local suppliers and food products from local sources (60.0%). The second statement respondents strongly agreed with was that it would be helpful if they had assistance in developing a system for buying local food (44.0%) (Table 8).

Table 8. Activities to help facilitate more local foods to local schools (n=85)

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
...lists of local suppliers and food products from local sources.	0.0%	5.3%	34.7%	60.0%
...assistance in developing a system for buying local food.	4.0%	13.3%	38.7%	44.0%
...better food safety information about local foods.	2.6%	17.1%	40.8%	39.5%
...better information about relevant state and federal regulations.	2.7%	17.3%	42.7%	37.3%
...a guidebook or manual on how to source and purchase local foods.	5.3%	13.3%	45.3%	36.0%
…tools available to publicize/market local foods to the school community (i.e. teachers, staff, etc.)	1.4%	20.3%	44.6%	33.8%

...more information and training about student's fruit and vegetable serving preferences.	1.3%	14.7%	52.0%	32.0%
…greater access to local food processing and packaging facilities.	6.8%	17.8%	45.2%	30.1%
...more information about local food purchasing experiences of public schools.	2.7%	6.7%	62.7%	28.0%
…support from a local foods work group.	2.7%	29.7%	44.6%	23.0%
…a Farm to School program mentor.	5.4%	28.4%	44.6%	21.6%
…information about local chefs and restaurants to help cook with local foods.	5.4%	43.2%	35.1%	16.2%

When asked which organizations, programs, or initiatives they were familiar with, respondents stated they were most familiar with Virginia Cooperative Extension (78.8%). The second organization, program, or initiative respondents were familiar with was *Virginia Grown* (71.8%) (Table 9).

Table 9. Familiarity with different organizations, programs, or initiatives related to Farm to School Program (n=85)

	Percentage of Response	Number of Responses
Virginia Cooperative Extension	78.8%	67
Virginia Grown	71.8%	61
National Farm to School Network	45.9%	39
Buy Fresh, Buy Local	36.5%	31
Local food hubs (e.g. the Local Food Hub, Fall Line Farms, etc.)	10.6%	9
A county or region-based agriculture marketing program	9.4%	8
None of these.	2.4%	2

The majority of respondents stated they participated in the 2009 Virginia Farm to School Week (57.1%) (Table 10).

Table 10. Participation in 2009 Virginia Farm to School Week (n=85)

	Percentage of Response	Number of Responses
Yes	57.1%	44
No	37.7%	29
Do not know / do not remember	5.2%	4

Additionally, of those respondents who stated they participated in the 2009 Virginia Farm to School Week, the majority of respondents stated they continued purchasing local foods throughout the 2009-2010 school year (61.4%) (Table 11).

Table 11. Purchased local food throughout the 2009-2010 school year (n=44)

	Percentage of Response	Number of Responses
Yes	61.4%	27
No	31.8%	14
Do not know / do not remember	6.8%	3

The majority of respondents also stated they participated in the 2010 Virginia Farm to School Week (68.8%) (Table 12).

Table 12. Participation in 2010 Virginia Farm to School Week (n=85)

	Percentage of Response	Number of Responses
Yes	68.8%	53
No	29.9%	23
Do not know / do not remember	1.3%	1

Additionally, of those respondents who stated they participated in the 2010 Virginia Farm to School Week the majority of respondents stated they continued purchasing local foods throughout the 2010-2011 school year (64.7%) (Table 13).

Table 13. Purchased local food throughout the 2010-2011 school year (n=53)

	Percentage of Response	Number of Responses
Yes	64.7%	33
No	33.3%	17
Do not know / do not remember	2.0%	1

When asked about what activities would be beneficial to help them participate in Virginia Farm to School Week or National Farm to School Month, respondents stated the best activity that could be done was find, promote, and help them connect to local farmers (65.9%). The second best activity was found to be supply signage and other local food marketing materials (55.3%) (Table 14).

Table 14. Activities to help increase participation in Farm to School Program (n=85)

	Percentage of Response	Number of Responses
Find, promote, and help you connect to local farmers.	65.9%	56
Supply signage and other local food marketing materials	55.3%	47
Coordinate an educational program to teach you how to participate in Farm to School.	43.5%	37
Distribute a press release template for your local foods program.	40.0%	34
Partner you with another school nutrition director who is experienced with Farm to School.	17.6%	15
None of the above.	7.1%	6
Other	0.0%	0

The majority of respondents stated their school nutrition program was self-managed (92.2%). Only six respondents stated their program was contract-managed (7.8%) (Table 15).

Table 15. Type of management for school nutrition program (n=85)

	Percentage of Response	Number of Responses
Self-managed	92.2%	71
Contract-managed [(*e.g.* food service management company (FSMC)]	7.8%	6

Of the respondents that stated their school nutrition program was contract managed, Aramark was the most commonly used company (50.0% each) (Table 16).

Table 16. Use of contract management companies (n=6)

	Percentage of Response	Number of Responses
Aramark	50.0%	3
Sodexho	33.3%	2
CBM Services	16.7%	1
Aladdin	0.0%	0
Chartwells	0.0%	0
Other	0.0%	0

Half of respondents who have a contract managed school nutrition program stated that their food service management company buys local food (50.0%) (Table 17).

Table 17. Purchasing of local foods by food service management companies (n=6)

	Percentage of Response	Number of Responses
Yes	50.0%	3
No	50.0%	3
I do not know.	0.0%	0

The majority of respondents stated their school nutrition program provides meals for neither summer school nor the summer food service program (45.9%) (Table 18).

Table 18. School nutrition program meal provisions (n=85)

	Percentage of Response	Number of Responses
Neither summer school nor the summer food service program	45.9%	39
Summer food service program	27.1%	23
Summer school under the national school lunch program	22.4%	19

The majority of respondents stated their schools do not participate in the Fresh Fruit & Vegetable Program (61.0%) (Table 19).

Table 19. Participation in the Fresh Fruit & Vegetable Program (n=85)

	Percentage of Response	Number of Responses
No	61.0%	47
Yes	39.0%	30

The average number of total school employees for each school division that work in the school nutrition program was found to be approximately 105 employees (Table 20).

Table 20. Average total number of employees that work in the school nutrition program for each school division (n=85)

Average total number of employee's	105

The average number of full-time school employees for each school division that work in the school nutrition program was found to be 34 employees (Table 21).

Table 21. Average number of full-time employees that work in the school nutrition program for each school division (n=85)

Average total number of full-time employee's	34

The average number of part-time school employees for each school division that work in the school nutrition program was found to be 66 employees (Table 22).

Table 22. Average number of part-time employees that work in the school nutrition program for each school division (n=85)

Average total number of part-time employee's	66

Almost all of the respondents stated their school division offers pre-made salads (94.7%), fresh fruits (100%), or fresh vegetables (94.7%). On average, pre-made salads and fresh fruits are offered nearly five days a week. Fresh vegetables are offered nearly four days a week, while salad bars are offered nearly two days a week (Table 23).

Table 23. School food offerings with fresh fruits and vegetables (n=85)

	Yes	No	If yes, how many days per week are these options typically offered?
Salad bars	31.6%	68.4%	1.6 days per week
Pre-made salads	94.7%	5.3%	4.6 days per week
Fresh fruits	100.0%	0.0%	4.6 days per week
Fresh vegetables	94.7%	5.3%	3.9 days per week

The majority of respondents stated their division purchased or received fruits and/or vegetables in the past year from a dedicated produce vendor (72.9%) or USDA foods (64.7%) (Table 24).

Table 24. Avenues for purchasing of fresh fruits and vegetables in the past year (n=85)

	Percentage of Response	Number of Responses
Dedicated produce vendor	72.9%	62
USDA foods (commodities)	64.7%	55
Department of Defense Fresh Fruit and Vegetable Program	40.%	34
Purchasing cooperative	15.3%	13
Direct from farmer	29.4%	25
Other	8.4%	7
None of the above	1.2%	1

The majority of respondents stated their contracts with either a primary or secondary food vendor does not limit their ability to purchase local foods (56.5%). Very few respondents stated their contracts with either a primary or secondary food vendor limits their ability to purchase local foods a lot (3.5%) (Table 25).

Table 25. Contracts with food vendors limiting ability to purchase local foods (n=85)

	Percentage of Response	Number of Responses
Not at all	56.5%	48
A little	12.9%	11
Not sure	9.4%	8
Somewhat	7.1%	6
A lot	3.5%	3
Much	0.0%	0

The majority of respondents were found to be female (72.4%) (Table 26).

Table 26. Gender of respondents (n=85)

	Percentage of Response	Number of Responses
Female	72.4%	55
Male	27.6%	21

The majority of respondents were found to be at least 45 years of age (74.7%) (Table 27).

Table 27. Age of respondents (n=85)

	Percentage of Response	Number of Responses
18 to 24 years old	0.0%	0
25 to 34 years old	5.3%	4
35 to 44 years old	20.0%	15
45 to 54 years old	41.3%	31
55 to 64 years old	26.7%	20
65 or older	6.7%	5

When asked the total number of years respondents had served in your current position as school nutrition director or school nutrition contact, the average response was 10 years (Table 28).

Table 28. Average number of years working in current position as school nutrition director or school nutrition contact (n=85)

Average Number of Years	10 years

When asked the total number of years respondents had worked in the school nutrition program, the average response was 15 years (Table 29).

Table 29. Average number of years working in school nutrition program (n=85)

Average Number of Years	15 years

The majority of respondents stated they grew-up in a rural setting (60.5%) (Table 30).

Table 30. Setting in which respondents grew up (n=85)

	Percentage of Response	Number of Responses
Rural, farm	31.6%	24
Rural, non-farm	28.9%	22
Suburban	28.9%	22
Urban	10.5%	8

The majority of respondents stated they currently live in the county or city for which you work (78.9%) (Table 31).

Table 31. Respondents who live in the county or city for which they work (n=85)

	Percentage of Response	Number of Responses
Yes	78.9%	60
No	21.1%	16

The majority of respondents stated they are interested in connecting their school division more with local foods (89.3%) (Table 32).

Table 32. Respondents interested in connecting their school division more with local foods (n=85)

	Percentage of Response	Number of Responses
Yes	89.3%	67
No	10.7%	8

The majority of respondents stated we could share their name with farmers in their area (88.7%) (Table 33).

Table 33. Willingness to share contact information with farmers in their area (n=85)

	Percentage of Response	Number of Responses
Yes	88.7%	63
No	11.3%	8

The majority of respondents stated they are willing to participate in a follow-up interview or focus group to discuss issues pertaining to the Virginia Farm to School Program (55.3%) (Table 34).

Table 34. Willingness to participate in follow-up discussions pertaining to the Virginia Farm to School Program (n=85)

	Percentage of Response	Number of Responses
Yes	55.3%	42
No	44.7%	34

When asked which location for a follow-up interview or focus group to discuss issues pertaining to the Virginia Farm to School Program would be best, the number one response was Charlottesville or Richmond (18.8% each), followed by Newport News or Roanoke (12.9% each) (Table 35).

Table 35. Best locations for follow-up to discuss issues pertaining to the Virginia Farm to School Program (n=85)

	Percentage of Response	Number of Responses
Richmond	18.8%	16
Charlottesville	18.8%	16
Newport News	12.9%	11
Roanoke	12.9%	11
Fredericksburg	10.6%	9
Abington	5.9%	5

Future Research

Next steps for this project include focus groups with local school nutrition directors, as well as interviews with farmers and local food distribution companies and organizations involved with the Virginia Farm to School Program. This research is expected to take place throughout the first half of 2012 with final project results available in October 2012. For more information, please contact the project directors.

References

Virginia Department of Agriculture and Consumer Services. (2012). *VDACS marketing services*. Retrieved from http://www.vdacs.virginia.gov/marketing/farm.shtml

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Appendix

Attached is the survey instrument developed and implemented to collect information from Virginia school nutrition directors.

RESULTS OF FOCUS GROUPS AND INTERVIEWS WITH VIRGINIA FARM TO SCHOOL PROGRAM STAKEHOLDERS: SCHOOL NUTRITION DIRECTORS, SPECIALTY CROP FARMERS, AND FOOD DISTRIBUTORS

OCTOBER 2012

By the Virginia Tech Department of Agricultural and Extension Education in partnership with the Virginia Department of Education and Virginia Department of Agriculture and Consumer Services

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Contact Information

For more information, please contact the project directors.

- Matt Benson, PhD Candidate, Department of Agricultural & Extension Education, Virginia Tech, Phone: (540) 522-0762, Email: mcbenson@vt.edu

- Kim Niewolny, PhD, Assistant Professor, Department of Agricultural & Extension Education, Virginia Tech, Phone: (540) 231-5784, Email: niewolny@vt.edu

Executive Summary

During the fall of 2011, a statewide survey of Virginia school nutrition directors was completed to explore their interest, knowledge, and participation in the Virginia Farm to School Program. As a follow-up to the survey, a series of focus groups and interviews were completed with farmers, food distributors, and school nutrition directors to explore their experiences with the Virginia Farm to School Program. During the spring and summer of 2012, two focus groups were completed with school nutrition directors, two interviews were completed with food distributors, and three individual interviews and one group interview were completed with specialty crop farmers. All participants had experience with the Virginia Farm to School Program and were found to be at least generally knowledgeable about Farm to School. Interviews with farmers revealed that they participated in the Virginia Farm to School Program for a variety of reasons. These reasons were primarily related to schools a local market outlet for their products, their concern for student health and well-being, and their commitment to connecting children to agriculture and farming. Farmer interviews revealed that participants had a difficult time with distribution, delivery, and in some instances, the price paid for their products. Farmers stated that both agricultural support organizations and school nutrition directors were critical to their involvement. Interviews with food distributors disclosed that the Virginia Farm to School Program was an opportunity for them to work with both farmers and schools to form a collaborative network for the development of regional agriculture and regional food systems. School nutrition director support was also found to be critical for food distributor participation in the Virginia Farm to School Program. Additionally, food distributors also stated that the annual Virginia Farm to School Week allowed them to connect with more schools and increase participation in the Virginia Farm to School Program. Focus groups with school nutrition directors revealed that participants viewed Farm to School as a strategy for improving the school food environment, and that gradual changes allowed them to get healthier, fresh fruits and vegetables into school meals. School nutrition directors acknowledged the importance of education as part of the Virginia Farm to School Program. Participants also stated that navigating the procurement regulations, distribution, and delivery of products were still obstacles and challenges. School nutrition directors explained that they liked the annual Virginia Farm to School Week, but that they preferred the week to be changed to another time during the school year when there was more local foods available for purchase. Results of these focus groups and interviews highlight the development of the Virginia Farm to School Program since it first began in 2007, and the need for continued work to improve the sale and distribution of Virginia foods to Virginia schools.

Introduction & Background

The Virginia Farm to School Program is an effort to increase the amount of fresh and nutritious Virginia Grown products offered in schools and to promote opportunities for schools and local farmers to work together (Virginia Department of Agriculture & Consumer Services, 2012). The Virginia Farm to School Program officially began through legislation passed in 2007, Senate Joint Resolution 347 (2007), which requested for the Virginia Secretary of Agriculture and Forestry and the Virginia Secretary of Education to establish a Farm to School Task Force charged with developing a plan for implementing Farm to School in Virginia. The task force met and identified a number of challenges to Farm to School in Virginia, including product availability, distribution, product costs, food safety, labor, and education. To address these challenges, the task force developed four recommendations which were to: 1) strengthen the partnership between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Education, 2) design a VDACS Farm to School website to include sections for farmers, distributors, and educational institutions, 3) identify funding sources for certification assistance in Good Agricultural Practices, and 4) conduct a pilot study (Virginia Farm to School Task Force Report). Starting in 2009, Virginia has held an annual Farm to School Week every year. In 2010, the Virginia General Assembly passed House Joint Resolution 95 (2010), which officially declared the second week of November as Virginia Farm to School Week. In October of 2010, researchers in the Department of Agricultural and Extension Education at Virginia Tech were awarded a Virginia Specialty Crop Block Grant to complete a statewide mixed methods evaluation of the Virginia Farm to School Program. As part of this project, Virginia Tech completed a series of focus groups and interviews with Virginia school nutrition directors, specialty crop farmers, and food distributors to better understand their experiences and involvement with the Virginia Farm to School Program.

Applied Research Methods

Following a preliminary analysis of the results from the statewide survey of school nutrition directors (available in a separate report), and reviewing previous Farm to School research (Izumi, 2008); project directors drafted a series of qualitative questions to ask supply chain stakeholders about their experiences with the Virginia Farm to School Program. Questions were developed for supply chain stakeholders including Virginia specialty crop farmers, food distributors, and school nutrition directors. In addition to developing a series of questions for each stakeholder group, worksheets were also developed for each stakeholder group to obtain additional information during each focus group or interview. The Virginia Tech Institutional Review Board reviewed the questions and worksheets, and approved the protocols (IRB Number 10-1093).

Project directors worked with the Harrisonburg City school nutrition director coordinating a Virginia Farm to School pre-conference at the 2012 Virginia School Nutrition Association Annual Conference in Virginia Beach, Virginia to schedule two focus group sessions with school nutrition directors, cafeteria/ kitchen managers, and program assistants. Project directors also worked with several specialty crop farmers and food distributors with experience selling Virginia foods to Virginia schools to coordinate a group and individual interviews. Figure one (below) summarizes the qualitative research approach employed to collect data from each Virginia Farm to School Program stakeholder group.

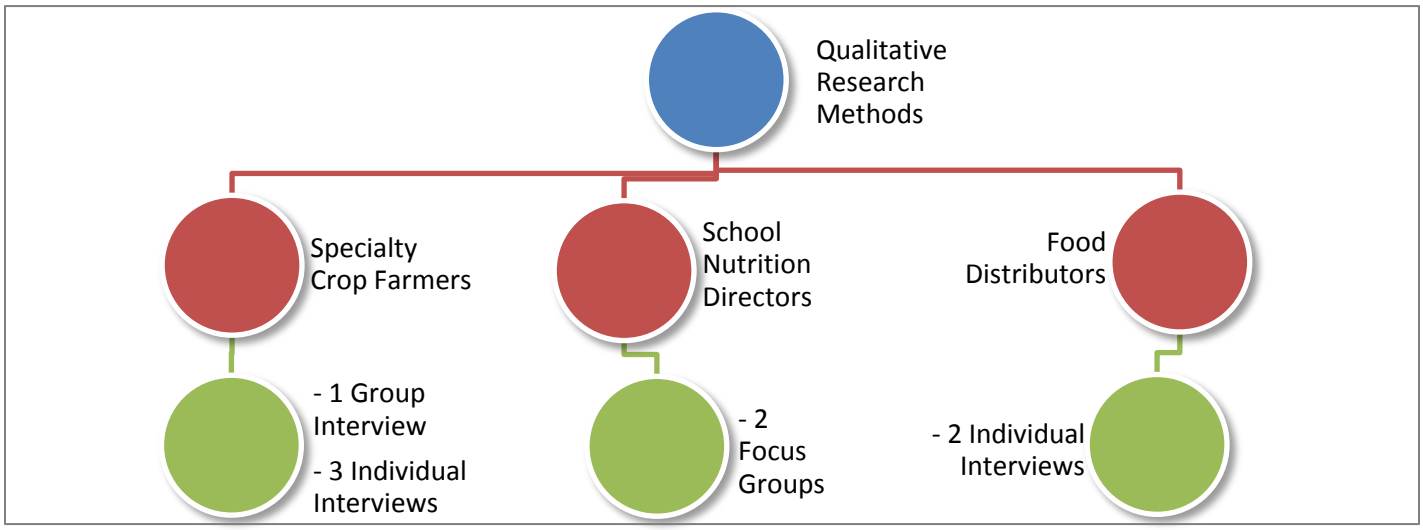

Figure 1. *Summary of Qualitative Research Methods*

Following the completion of each interview and focus group, the recorded audio from the session was transcribed verbatim. Interviews and focus groups lasted between 45 and 90 minutes each. Additionally, the information gathered through each worksheet was compiled and summarized. Once all of the transcripts were complete, the researchers read through each of the transcripts and developed a coding schematic which summarized major categories or themes within the data. This was used during the coding of each transcript to group similar experiences. Atlas.ti software was used to store, code, and categorize the transcripts and qualitative data for analysis. Once all of the transcripts were coded, researchers grouped similar experiences together and formulated major themes.

Results

Twenty-two participants from fourteen different school divisions participated in the two school nutrition director focus groups. In addition to school nutrition directors, cafeteria and kitchen managers, and program assistants also participated in the focus groups. All participants who completed the worksheets prior to the focus group stated that they were at least generally familiar with the Virginia Farm to School Program (n=19). Twelve participants stated they were very knowledgeable about the Program, and seven stated that they were somewhat familiar with the Virginia Farm to School Program. Three individuals participated in a specialty crop farmer group interview, which took place in Virginia Beach, Virginia. Additionally, three individuals participated in separate specialty crop farmer interviews, which took place in three separate regions of the Commonwealth, including the northwestern region, the central region, and the eastern region. During each of the farmer interviews, all participants who completed the worksheet stated that they were very knowledgeable of the Virginia Farm to School Program (n=3). Additionally, each participant indicated that they had sold farm products to local school divisions as part of a local Farm to School program (n=3). Two individuals participated in separate food distributor interviews which took place in two different regions of the Commonwealth, the central region and the eastern region. All food distributor participants who completed the worksheets prior to each of the interviews stated that they were very knowledgeable of the Virginia Farm

to School Program (n=2). Additionally, each participant stated that they had sold farm products to local school divisions as part of a local Farm to School program (n=2). Below is a summary of products that have been purchased as part of the Virginia Farm to School Program (Table 1).

Table 1

List of Products Sold or Purchased for the Virginia Farm to School Program

Fruits	**Vegetables**	**Vegetables (cont.)**	**Meats**	**Other**
Apples	Broccoli	Onions	Chicken	Butter
Blackberries	Cabbage	Peppers	Ground beef	Cheese
Cantaloupe	Carrots	Radishes	Pork	Eggs
Honeydew	Collard greens	Spinach		Flour
Nectarines	Cucumbers	Squash		Milk
Peaches	Eggplant	Sweet potatoes		
Strawberries	Green beans	Turnips		
Tomatoes	Kale	White potatoes		
Watermelon	Lettuce (assorted)	Winter squash		

Major themes from each of the stakeholder groups including Virginia specialty crop farmers, food distributors, and school nutrition directors are summarized on the following pages.

Experiences of Specialty Crop Farmers Participating in the Virginia Farm to School Program

Overall, the experiences of farmers participating in the Virginia Farm to School Program were found to be more diverse compared to Virginia food distributors and Virginia school nutrition directors. When asked how big of a percentage of sales schools represented, farmer participants stated that schools ranged from a small percentage of sales to as much as 75 to 80 percent of sales. Farmers used a range of distribution techniques which included partnering with local and regional food distributors to help transport their products, as well as direct marketing methods such as delivering their products to individual schools. When farmers were asked about how many schools they worked with as part of their Farm to School efforts, participants provided a range of answers from just a few schools to approximately 100 different schools.

Although there were differences between farmers participating in the Virginia Farm to School Program, we also found a number of similarities. One similarity among farmers was their growing practices. All of the participants stated that they were producing food for schools naturally, without the application of chemical sprays and fertilizers, or were using organic sprays. Additionally, another similarity between farmers was the role of the school nutrition director. All of the farmers interviewed spoke about how important it was for the school nutrition director to be engaged in Farm to School, and that the director's engagement allowed for them to connect to school divisions as a local market outlet. Different farmers spoke about the school nutrition director reaching out to them for products and even visiting their farms to learn more about their operation.

Farmers were found to have a variety of different motivations for participating in the Virginia Farm to School Program. Several participants stated they became involved in Farm to School to provide healthy, fresh foods to schools as a result of their concern for student health and wellness. One participant explained "I want kids to eat fresh, because I want kids to have the experience of a turnip, kale, collard greens, corn, real sweet corn, not corn that has been genetically modified." He continued to say "It is about the kids, I want kids to experience natural food, real natural food." Similarly, a different participant was involved with Farm to School because they saw it as a way to connect kids to agriculture and farming while potentially improving student health. She stated "People need to know where their food is coming from. Ultimately, we pay for what we put in our mouth. Look at people in general and the health issues that people have at this point and what they are eating." Another participant stated that he was involved with Farm to School because it allowed him to farm the way he wanted to farm. Rather than producing a lot of different crops and selling them at a farmers market, he preferred concentrating on producing just one product primarily for schools. He stated "We decided to concentrate on one product, do it well, and make it work." Furthermore, another farmer spoke about his passion for giving back to schools as part of the Virginia Farm to School Program and visiting schools to help students learn more about agriculture and farming. This was his way of giving back. He explained "I believe everybody in this country is committed to giving something back to the community. And this is, for what we do, this is our way of doing it. For our occupation, it's a way that we can give our time and our expertise."

A farmer who had experience selling ground beef to a local school division as part of the annual Virginia Farm to School Week stated that price was her biggest obstacle to participation. She explained "The price point was the big, big stumbling block. They (school divisions) get subsidized food and there is only a limited amount of dollars. But the meat they get commercially is below cost and they are buying it from big corporations that are making their money on pennies." In addition to the price, her experience delivering the product to the nearby school division and getting paid in a timely fashion were two other challenges. She explained "The logistics was a challenge because the school was not prepared to help with the distribution at all. So I physically had to hand deliver all of it to each school. And then I had to wait for the school to go before the board of supervisors to get reimbursement or approval for funding."

Similarly, another one of the major challenges farmers discussed was the distribution and delivery of local foods to schools. One participant stated "The big thing is the logistics." He explained

> The biggest thing, probably the key thing that allowed us to get into this (Farm to School) is that we were willing to deliver to schools initially and make it work. And that takes a lot of time and dedication. I know some other people that grow a product but they are not willing to deliver to the schools without charging an exorbitant amount for delivery. And so right there, that's one of those sacrifices I had to make.

Many of the participants stated that they did not have formal contracts but instead started working with schools through simply a handshake or some other off-contract/bid process. One participant stated "What I have done is I got a commitment handshake that basically says when I grow this, you will buy it, at this price." Farmers throughout the interviews stated that they had worked with a variety of different agricultural

service providers and organizations, including the Virginia Department of Agriculture and Consumer Services, Buy Fresh Buy Local, Virginia Cooperative Extension, administration at local school divisions, Parent-Teacher Associations, and numerous school nutrition directors. The information about Farm to School these organizations provided, as well as their support for Farm to School, was found to be important for successful Farm to School events and activities throughout Virginia.

Experiences of Food Distributors Participating in the Virginia Farm to School Program

Two major themes discussed throughout the interviews with food distributors were: 1) the opportunity to help network diverse food system stakeholders together through Farm to School, and 2) the procurement of local foods to school divisions. The distributors stressed Farm to School as a collaborative community-based program which was successful in developing partnerships throughout their regions. One participant stated "I think one reason we've been pretty successful is our ability to have relationships both with our farmers and with the institutions that were selling to." She explained "I think about our ability to have these really good relationships with both the farmers and the people that are buying the food. And to be able to share the information in-between the two." This participant spoke about her work to develop strategies that informed farmers about what types of products to grow for schools and informed schools about what types of products were in season. One of the food distributors worked with schools as a secondary market for their products, while the other food distributor saw schools and other institutions as a primary market. For the food distributor that viewed schools and other institutions as a primary market, schools made up between 15 to 20 percent of their sales, or approximately $125,000 in sales per year.

A third theme that came up throughout the interviews was the opportunity for food distributors to use the Virginia Farm to School Program as an agricultural development tool that helped farmers grow more products for increased profitability. Both food distributors spoke about working with farmers to strategically plan products for school food distribution and how important it was to think creatively about different products that could be sold to schools. One participant stated "Our farmer services division is really where that's happening. It's visiting all the farms. It's working really closely with production planning, and it's helping farms that are ready and willing to scale up production. It's developing new farmers too."

A fourth theme that was discussed throughout the interviews with food distributor was Farm to School programs as a way to connect more school-aged children to agriculture and farming. One participant talked about helping to coordinate local farmer presentations as part of Farm to School programs. She stated that this activity was an important part of helping students understand where there food comes from, and what farming is like. Participants saw Farm to School programs going beyond farm to cafeteria activities, and worked to help educate students about the importance of eating fresh food for better health and nutrition.

Both food distributors emphasized the importance of the Virginia Farm to School Week as a method for increasing participation in the Virginia Farm to School Program. When asked if they thought the Virginia Farm to School Week had a positive impact, one participant stated "Yes, it definitely has. Because what it has done is given people a reason to get their feet wet, and try it out. So they have an excuse or a reason to pursue local food for this one week." Another participant stated she wanted to see the week extended, and

for more educational resources to be provided to help school nutrition director's scale up Farm to School activities.

In addition to the Virginia Farm to School Week, support of Farm to School by local school nutrition directors was also found to be important. One participant stated "First and foremost, it's who's in charge and where the directive is coming from. So, for example, (name removed) Schools have been very proactive in pursuing a partnership with us, and have been very receptive to our interests in working with them. And so it has been a good partnership because they have really made a commitment on their end to purchase local food for their menus." She further explained "It starts for us with the nutrition director. I don't know internally, there may be at the schools some school administration, but for us, the relationship usually starts with the nutrition director and then in some cases, goes down to the individuals managing the cafeterias."

Additional themes discussed throughout the interviews included the importance of a central drop off distribution facility for each school division to eliminate the burden to go to a large number of drop-off locations, and the need to scale up the supply of local and regional food production. Participants emphasized the importance of diverse Farm to School stakeholders and their ability to keep the momentum going so that schools would continue to participate in the Program.

Experiences of School Nutrition Program Staff Participating in the Virginia Farm to School Program

The most prominent theme from the two focus groups with school nutrition directors was their view of Farm to School as a strategy or pathway to improving the school food environment. One cafeteria manager stated "I didn't see it gradual. I saw it from like bump, 300 pounds of French fries, to bump, seeing kindergarteners eating salad. And it was like, oh my gosh, I just can't believe how much it has changed in a few years." The cafeteria manager explained how her school nutrition director had implemented these changes by stating "She has done it very gradually. To see what she and the others who are involved have accomplished, there are kindergarteners, first graders, eating beautiful little salads which I would have never seen." Many other participants also talked about the slow changes they made in their cafeterias to include healthier, fresh fruits and vegetables in school meals. Participants also described how they have worked to reduce waste and implement innovative cafeteria practices to save money and increase the amount of funds available for local and regional foods. Additionally, participants spoke about the changing preferences of students towards more fresh and healthy foods.

A second major theme was the need for education and training to help facilitate local and regional foods to schools. Many of the school nutrition directors mentioned the Virginia Farm to School conference in 2008 as the place where they first learned about Farm to School in Virginia. One participant stated "I think meetings like this are where we first heard about Farm to School." Another participant agreed and said "Yeah that is exactly what I was going to say. I went to the very first Farm to School conference, because I know Andrea and Trista were there and spoke. You were there. Leanne was there." Virginia Cooperative Extension faculty and their educational programs were commonly brought up as places where school nutrition directors had received assistance in Farm to School.

A third prominent theme that was discussed throughout the focus groups was the procurement of local foods by school divisions for their cafeterias. Many of the school nutrition directors spoke about having a difficult time navigating the procurement regulations that relate to purchasing local foods, and how time-consuming it can be to interpret state and federal regulations. One school nutrition director suggested that the (to be developed) Virginia Farm to School Program Resource Guidebook should specifically address issues related to procurement. She stated "So I think what you guys are doing with this guidebook, I mean, that is really that procurement piece. If you could get that down in this thing, you are a god."

The distribution of local foods to school cafeterias was another major theme discussed throughout the focus groups. One school nutrition director of a large division stated "One of our challenges is because we have 83 schools with 82 of them having a cafeteria. And we do not have a central warehouse. And we need to have it (food) delivered to our schools. So, that is a huge challenge." Another school nutrition director added "It (Farm to School) is outside of the system. In other words, it doesn't really fit in with our distribution model, and our bidding system." He continued on to say "When we try to highlight a Farm to School event, it is invariably just one more thing to do."

Most participants stated that they thought the Virginia Farm to School Week should be changed to another time in the school year. They spoke of the Virginia Farm to School Week as a great event to participate in, but it being one of the worst times of the year for local food availability. Additional themes included Farm to School as a way to teach students about agriculture, food, and growing up healthy, the price and supply of local foods, and policy and regulations governing schools' purchase of local foods. Furthermore, other themes commonly discussed included the superior taste of local foods and the Virginia Farm to School Program as an economic development strategy for Virginia farmers and communities.

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Appendix

Attached are supporting documents that were used to collect information during the focus groups and interviews with school nutrition directors, farmers, and food distributors. For each group, we developed: 1) a worksheet for the participants to complete prior to the focus group / interview, and 2) a series of questions to help guide the conversation.

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Virginia Cooperative Extension
Virginia Tech • Virginia State University
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Virginia Farm to School Resource Guide: Helping Connect Virginia Foods to Virginia Schools

Authors:

Matthew Benson
Research Assistant
Department of Agricultural and Extension Education
Virginia Tech

Kim Niewolny
Assistant Professor and Extension Specialist
Department of Agricultural and Extension Education
Virginia Tech

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Author Contact Information

Matthew Benson, PhD
USDA Farm to School Program, United States Department of Agriculture
Email: matthew.benson@fns.usda.gov
Phone: (202) 720-6740

Kim Niewolny, PhD
Department of Agricultural and Extension Education, Virginia Tech
Email: niewolny@vt.edu
Phone: (540) 231-5784

Steering Committee Members

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"Everything is right about Farm to School: healthy fresh food, enhanced economic opportunity for farmers, and education for children about where food comes from. That's a trifecta!"

Kathleen Merrigan
Former Deputy Secretary, United States Department of Agriculture [i]

Welcome!

This *Virginia Farm to School Resource Guide* is designed to help cultivate connections between the many diverse stakeholders that support the Virginia Farm to School Program. This guide is intended to help facilitate locally and regionally-grown Virginia foods to school cafeterias and school-based meal programs. It contains research-based information, resources, and advice that can help start or expand a Farm to School initiative in your community.

Farm to School programs locally and nationally come in many different shapes and sizes that are ultimately unique to the communities that develop them. Stakeholders that may find this guide helpful include: Virginia school nutrition directors, farmers, food distributors, Virginia Cooperative Extension professionals, and other school-based and agriculture-based educators and service providers interested in Farm to School programs.

Purchasing Virginia-grown foods for school meals has been shown to be good for students, local farmers, and communities.[ii] Through Farm to School programs, students across the United States are enjoying fresh, locally and seasonally grown foods while learning about agriculture, human nutrition and food production. The Virginia Farm to School Program was established in 2007 through Senate Joint Resolution 347 that requested for the Virginia Secretary of Agriculture and Forestry and the Secretary of Education to establish a Farm to School Task Force charged with developing a plan for implementing Farm to School in Virginia. The Virginia Farm to School Program is an effort to increase the amount of fresh and nutritious Virginia Grown products offered in schools and to promote opportunities for schools and local farmers to work together. In 2009, the first Virginia Farm to School Week took place, and in 2010, the Virginia General Assembly passed a resolution making the second week of November the official Virginia Farm to School Week.

When supporting the Virginia Farm to School Program, we suggest that you develop collaborative partnerships with other Farm to School supporters. Through these partnerships, small successes can grow into large achievements that ultimately positively impact Virginia's children, farmers, and communities. Here in Virginia, we are pleased to join a national effort that connects schools with their local agricultural communities. By doing so, Virginia is helping school-based youth understand where their food comes from and how their food choices impact their health, community, and the environment. We also support the local food and farm economy by promoting Virginia farmers!

Introduction to Farm to School

Today, Farm to School activities and programs take place in all 50 states as well as Washington, D.C. According to the National Farm to School Network, there are almost 12,500 schools involved with Farm to School nationally. These programs reach over 5.7 million students and purchase more $13 million dollars of locally produced foods. [iii] Evidence is beginning to show that Farm to School is an opportunity to create agricultural and regional economic development, while improving student nutrition, promoting healthy eating habits, and teaching kids where their food comes from. [iv, v, vi, vii, viii, ix, x]

Overview of Farm to School and the Virginia Farm to School Program

Farm to School is typically defined as "a program that connects schools (K-12) and local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing agriculture, health and nutrition education opportunities, and supporting local and regional farmers." [iii] The United States Department of Agriculture (USDA) defines Farm to School similarly, and as part of the *Know Your Farmer, Know Your Food* initiative, the USDA has made Farm to School a key priority area. [xi, xii] Farm to School programs are frequently thought of as a 'win-win' solution for both children and farmers. [xiii, xiv]

The concept of Farm to School emerged in large part because of a handful of individual's work, which first began during the mid-1990's. [xiii] Farm to School grew out of primarily two separate efforts in north Florida on the east coast of the United States (U.S.), and southern California on the west coast of the U.S. In north Florida, a USDA consultant worked to support local farmers, particularly minority farmers, by developing school cafeterias as a potential market for certain crops. [xv] In southern California, a fruit and vegetable salad bar filled with products from local and regional farmers was implemented in place of the standard hot meal at a low income school in Santa Monica. [xv]

In Virginia, Farm to School began as a result of state legislation passed in 2007, Senate Joint Resolution 347 (2007), which requested for the Virginia Secretary of Agriculture and Forestry and the Secretary of Education to establish a Farm to School Task Force charged with developing a plan for implementing Farm to School in Virginia. The Virginia Farm to School Program is an effort to increase the amount of fresh and nutritious Virginia Grown products offered in schools and to promote opportunities for schools and local farmers to work together. [xvi]

> *"Virginia's Farm-to-School program is about creating connections between growers, distributors and educational institutions. Through these connections, we can provide healthy, locally grown foods and support our agricultural economy. Virginia's Farm-to-School creates a win-win situation for Virginia's children and for Virginia's farmers."*
>
> --- Todd Haymore, Virginia Secretary of Agriculture and Forestry

In 2009, the first Virginia Farm to School Week took place, and in 2010, the Virginia General Assembly passed a resolution making the second week of November the official Virginia Farm to School Week. [xvii] A 2011 survey by Virginia Tech found that 69 percent of respondents participated in the 2010 Virginia Farm to School Week. Of those participants, 65 percent continued to purchase local food throughout the 2010-2011 school year. Furthermore this same survey found that all respondents had at least heard of the Virginia Farm to School Program, and 55 percent of respondents stated that they were very knowledgeable about Farm to School. [xviii]

Many different types of Farm to School programs exist throughout Virginia. A 2011 survey of Virginia school nutrition directors found that 86 percent of respondents are serving meals featuring local foods. This included school divisions in every part of the Commonwealth.

Additional key findings of this survey include:

- 45 percent of respondents reported developing purchasing relationships with local farmers.
- 40 percent of respondents reported inviting a farmer to a school to support education about local food and agriculture.
- 36 percent of respondents reported planting a school garden.
- 32 percent of respondents reported working with teachers to include classroom-based curriculum featuring local foods and agriculture.
- Virginia School nutrition directors most strongly agreed with the potential benefit of Farm to School as it increases support of Virginia farms and/or businesses and that schools support their local economy and local community by purchasing local foods.
- Virginia School nutrition directors stated that the biggest potential problems of Farm to School were the seasonal availability of local foods and the inadequate supply of local foods.
- To increase the purchasing of local foods as part of Farm to School programs, Virginia school nutrition directors stated that they wished that more local food was available from distribution companies who they normally purchase from.
- Virginia School nutrition directors also stated that if there was one place for ordering local foods from multiple farmers their likelihood for greater participation in Farm to School would increase.

A full report of these findings from the survey is available online, http://www.farmtoschool.org/VA/pubs.htm.

Moving Forward with Policy: Virginia and National Farm to School Legislation

Throughout the U.S. and in Virginia there are a series of state and federal policies that support Farm to School. Historically, these policies have been enacted as ways to encourage and improve a school nutrition director's ability to procure or source local and regionally grown/raised foods.

Second Week of November as Virginia Farm to School Week

In Virginia, as a result of legislation passed in 2010 (House Joint Resolution 95), the second week of November is the official Virginia Farm to School Week. [xvii] Each year across the Commonwealth, farmers, local school nutrition directors, cafeteria managers and assistants, food hubs and food distributors partner to put on local and regional Farm to School events and programs. These events have been shown to help connect local farmers to local schools as a market, highlight school and community gardens, teach children about agriculture, how food is grown, and where it comes from, and incorporate Virginia Grown products as part of the school lunch system.

Some of the activities and programs completed during past Virginia Farm to School Week events include:

- Serving Virginia grown or raised food in school breakfasts, lunches, or classroom snacks.
- Tasting specialty crops and other Virginia grown or raised foods in school classrooms.
- Building or celebrating school gardens.
- Promoting agriculture in schools through cooking contests, cooking demonstrations, or meet the farmer talks.
- Teaching students culinary and food preparation skills.
- Holding a farmers market featuring Virginia grown or raised foods at or near a school.
- Student field-trips to nearby farms or community gardens.
- Hosting after-school events such as film screenings and community-based panel presentations and discussions.

> *"Virginia's Farm-to-School Program is a true "win-win". Our students benefit from being served fresh, local food at school. These same schools represent a significant new market opportunity for Virginia farmers. It is my pleasure to bring this resolution before the General Assembly and to call attention to Farm-to-School Week in the Commonwealth."*
>
> --- Delegate Ed Scott, Virginia General Assembly

October as National Farm to School Month

As a result of federal legislation passed in 2010 (House Resolution 1655), nationally, October is the official National Farm to School Month. [xix] Designating October as Farm to School Month is an attempt to encourage local farmers, school nutrition directors, and other food system

stakeholders to develop and celebrate Farm to School programs and activities. According to the National Farm to School Network, more than 131,490 students participated in National Farm to School Month activities and schools used $101,011 worth of local food during October 2012. Because only a portion of schools are familiar with local area Farm to School programs, these numbers likely represent only a fraction of actual participation and impact. The National Farm to School Network reports that participation could easily be 10 or even 20 times higher. For more information about October as National Farm to School Month, please visit the official Farm to School Month website, http://www.farmtoschoolmonth.org.

USDA Farm to School Grant Program

As a result of the 2010 Healthy Hunger Free Kids Act, in 2012, the USDA launched the USDA Farm to School Grant Program with the objective of assisting "eligible entities in implementing farm to school programs that improve access to local foods in eligible schools." [xx] Through this grant program, approximately $5 million dollars is available annually to schools, state and local agencies, producers and producer groups, non-governmental organizations, and Indian Tribal Organizations for Farm to School activities.

In 2012, the USDA funded 68 local Farm to School programs in 37 states including two Farm to School programs in Virginia. Funded programs in Virginia include those sponsored by the Rappahannock County Public Schools in partnership with Page County Public Schools and Orange County Public Schools, as well as the Richmond City Public Schools.

2013 USDA FARM TO SCHOOL GRANT PROGRAM VIRGINIA AWARDEES

Rappahannock County Public Schools. As part of the first USDA Farm to School Grant awardees, Rappahannock County Public Schools was awarded a planning grant as lead partnering with three regional rural school districts in Virginia—Page, Orange, and Rappahannock Schools. Together, they applied for a cluster planning grant to build upon each of their isolated successes in using local foods, educating children through school gardens, and connecting with local producers. Currently, they are working to identify and collaborate with local farmers, local distributers, food service staff, county extension staff and community stakeholders who are interested in planning and implementing Farm to School programs. Project directors are also training cafeteria staff to work with fresh foods and exploring ways to increase agricultural and nutritional education in all three districts.

Richmond City Public Schools. Richmond City Public Schools was also awarded a planning grant to expand their current Farm to School efforts beyond the annual celebration of Virginia Farm to School Week. The project covers four objectives that will address: (1) school nutrition staff readiness through education and training utilizing Farm to School best practices program offerings, and salad bar training, (2) a district-wide needs assessment to determine capacity for Farm to School activities; (3) building a network of contacts to help source local food purchases, and, (4) recruitment of local stakeholders and partners from the Richmond Public School Garden Task Force to serve as planning committee members in the development of a Farm to School action and sustainability plan.

The USDA has a team of staff members supporting Farm to School. Names and contact of these individuals, as well as more information including recorded webinars about the USDA Farm to School Grant Program can be found by visiting the USDA Farm to School Program, http://www.fns.usda.gov/farmtoschool.

USDA Fresh Fruit & Vegetable Program

The USDA Fresh Fruit and Vegetable Program (FFVP) is a federal program that encourages the inclusion of healthy Virginia foods in schools and classrooms. The FFVP is administered by the USDA in partnership with the Virginia Department of Education. According to the USDA, the program can help children learn more healthful eating habits and has been successful in introducing school children to a variety of produce that they otherwise might not have the opportunity to sample. [xx] The program began as a result of the 2002 Farm Bill, and was reauthorized in the 2008 Farm Bill. According to the USDA, the FFVP operates in selected low-income elementary schools and provides $158 million in assistance to state agencies. States then select schools to participate based on criteria, including the requirement that each student receives between $50 and $75 worth of fresh produce over the school year. More information about the FFVP is available at the USDA website, http://www.fns.usda.gov/ffvp.

Additionally, the USDA has also developed a handbook to help schools apply for this program and can be downloaded from the Internet at http://www.fns.usda.gov/cnd/FFVP/handbook.pdf.

Small Purchase Threshold

When procuring goods and services for the Child Nutrition Programs, a school food authority must determine whether they must use an informal or formal procurement method. It is important to understand and then identify which method best meets the needs of your individual school food service operation. Informal procurement occurs when a school food authority's purchases fall at or below the federal, state, or local small purchase threshold (*i.e.*, whichever is more restrictive). The informal procurement method is commonly referred to as procurement under the small purchase threshold or simplified acquisitions. [xii]

Under federal law, the small purchase threshold allows for school nutrition directors to complete more small purchase procurements using relatively simple and informal methods for securing services, supplies, or other property. Under Federal Law, [41 U.S.C. 403(11)], the small purchase threshold was increased from $100,000 to $150,000 in October 2012 (as said in memo code SP 01-2013 CACFP 01-2013 SFSP 01-2013). However, in Virginia, the small purchase threshold is set at $50,000. This means that school nutrition directors must follow the Virginia rule as it relates to all USDA Food and Nutrition Service program procurements. In other words, Virginia school nutrition directors can purchase local and regional foods from Virginia farmers without using formal procurement process as along as the purchase is lower than $50,000. It is important for each school nutrition director to check if the small purchase threshold is more restrictive for their municipality (i.e., county or city) than for the Commonwealth of Virginia.

For more information about this policy, visit the USDA website that outlines using both informal and formal procurement methods. The Virginia small purchase threshold is outlined at the Department of General Services.

USDA Farm to School Procurement Methods Website
http://www.fns.usda.gov/cnd/f2s/Procurement.htm

Geographic Preference

Through the 2008 Farm Bill, the Secretary of Agriculture was instructed to help schools purchase locally grown and locally raised foods to maximum extent possible. The geographic preference rule was put in place through federal legislation to help give school nutrition directors the ability to include language in their bids that allows for the procurement process to preference the sourcing of local and regional foods.

A few new resources are available to help individuals understand issues related to using the geographic preference rule. The USDA Farm to School Program recently published a factsheet that outlines the details of procuring local foods using geographic preference. This fact sheet is available online. Additionally, School Food FOCUS has also published a primer on geographic preference which can be downloaded on their website. Within the primer, individuals will learn about the federal authority for using geographic preference and how the federal authority coincides with state procurement laws.

USDA GEOGRAPHIC PREFERENCE FACTSHEET

"Federal regulations do not prescribe the precise way that geographic preference should be applied, or how much preference can be given to local products. Thus, there are a variety of ways to apply geographic preference and one way is not considered better or more effective than another. The key is to be sure that use of geographic preference does not restrict free and open competition. Further, regardless of which method is used, the selection criteria must be clearly described in all solicitation materials."

USDA Geographic Preference Factsheet
http://www.fns.usda.gov/cnd/F2S/pdf/F2S_geo_pref.pdf

School Food FOCUS Website
http://www.schoolfoodfocus.org

Virginia Farm to School Recommendations

To continue strengthening the Virginia Farm to School Program, there are a number of strategies and best practices that can be implemented by Virginia school nutrition directors, farmers, food hubs and food distributors, and agricultural educators. These activities are based on research that was completed as part of the Virginia Farm to School survey and a series of interviews and focus groups with Farm to School stakeholders. Below are these recommendations summarized by each stakeholder group.

Recommendations for School Nutrition Directors

Below are a few important points to know when starting or expanding your Farm to School program and working with farmers to source locally and regionally-grown foods.

School nutrition directors are critical to developing successful Farm to School programs. Through interviews and focus groups with farmers and food distributors, we found that school nutrition directors are one of the most important individuals in the community to help develop successful local and regional Farm to School programs. As a school nutrition director, you may be very familiar with Farm to School and working with local foods or just starting to become familiar with and knowledgeable about Farm to School.

When working with others to develop a local Farm to School program, real-world experiences have showed that there are several best practices. Below are a series of recommendations developed for school nutrition directors who are just getting started with Farm to School activities.

1. **Start small and grow slowly.** Start small with a single product, one day, or one school. Starting small can help you learn best practices for working with local and regional foods that will allow you to grow your Farm to School program. In starting small, you can then develop annual goals for sourcing of locally and regionally-grown foods.

2. **Networks are essential**. Build a network of farmers, food distributors, and Farm to School supporters. This network of individuals and organizations can be critical to creating or expanding a successful Farm to School program.

"My best advice is to start small. School Nutrition Directors have so many irons in the fire and this shouldn't be overwhelming. Look at your existing menus, see where you can painlessly substitute a local for a non-local item, and go from there. If every district in Virginia procured even a small percentage of their foods from local farmers and producers, it would make a huge positive economic impact."

--- Andrea Early, School Nutrition Director, Harrisonburg City Public Schools

You may want to contact your local Virginia Cooperative Extension office for assistance in locating local farms that produce local foods. A complete listing of local Virginia Cooperative Extension offices can be found online at the Virginia Cooperative Extension website, http://www.ext.vt.edu. Developing a network may also mean contacting other businesses, institutions, and organizations who purchase food for the names of local farms and farmers who sell local or regionally-grown foods. The Virginia Department of Agriculture and Consumer Services is a good resource to help identify farms and farmers for participation in local and regional Farm to School programs.

3. **Plan for local logistics**. Consider the logistics such as cost of local foods, bid process, distribution, storage, food preparation time and space, supply, and ordering/packaging details. Research has found that the logistics of buying locally and regionally-grown foods can be sometimes challenging. As a school nutrition director, it is important that you consider all of the logistics of local food distribution and have a detailed plan for delivery and preparation.

4. **Build a relationship with your food distributor.** Ask your food distributors to purchase locally or regionally-grown foods. If you are working with a food distributor to purchase locally or regionally-grown foods, ask for the names of the farms they are working with.

5. **Highlight the successes.** Share good news about the program success with school and community stakeholders. Sharing information about your successful Farm to School efforts can increase the support of your program through the community. This can also mean highlighting local foods on your menus or giving them special names on your menus to help inspire students to eat more local foods.

6. **Build school system and community support.** Educate students, teachers, parents, and community members about the importance of Farm to School. By educating these stakeholder groups, more individuals may be willing to assist with your Farm to School program efforts or provide additional resources for completing Farm to School programs.

7. **Become familiar with the seasonality of Virginia agriculture.** Learn about the seasonality of locally-grown foods in Virginia. It is important for you to know when certain crops are in season so that you can appropriately include them on your school menus. The appendix contains a produce availability calendar for you to plan seasonal meals by including locally and regionally-grown foods.

Many of these recommendations are further explained in detail at the Virginia Farm to School website, under “Program Tools,” and can be found online at: http://www.vdacs.virginia.gov/marketing/farm.shtml.

Checklist for Schools: Working with Farmers on Farm to School

When working with farmers and other food distributers to order Virginia grown/raised foods, we recommend being conscious of what types of crops or meat products the farmer is producing, the production methods used, product handling and storage methods, transportation logistics, and food safety standards. Below are a series of questions we suggest asking when starting to work with a new farmer as part of your Farm to School program.

1. What types of fruits, vegetables, or meats do you produce or grow?

2. What is your pricing structure for (insert type of food)…?

3. What is your insurance coverage? What type and how much?

4. Have you considered GAP (Good Agricultural Practices) certification? If so, have you started that process?

5. Are any of your products certified organic?

6. What types of procedures are in place to ensure food safety and traceability within your agricultural operation?

7. Do you provide a means for delivering your products?

8. Would you be willing to work through a distributor?

Recommendations for Farmers

Below are a few important points to know when starting or expanding your participation in the Virginia Farm to School Program and working with schools to market your locally and regionally-grown foods.

Farmers are an essential part of successful Virginia Farm to School Programs. They provide products available for school meals and can help educate students about different agricultural growing practices and the rural lifestyle. By selling your products to local schools, it is likely that your business will receive increased visibility. There are several strategies that farmers can employ to better connect their products to local and regional school divisions.

Mr. Sandy Fisher, local farmer and his cow, Brookview Farm, Goochland County, grass fed and finished cattle farm.

1. **Become familiar with the schools in your community**. Visit the Virginia Farm to School webpage on the Virginia Department of Agriculture and Consumer Services website (http://www.vdacs.virginia.gov/marketing/farm.shtml) to see the list of which schools are currently interested in purchasing from Virginia farms. If you see a school in your region that you may be interested in working with, we suggest meeting with the school nutrition director to learn about their school nutrition program.

2. **Talk about your farm operation.** When working with a Virginia school nutrition director or food distributor, be prepared to share details and supportive information about your farming operation. They may also want to tour your farming operation or see and taste product samples.

3. **The right products at the right time.** Determine which products you can grow and sell to local and regional school divisions. You will have to determine how your products get to each school, what volume the school nutrition director or food distributor may want, the condition of the product (washed, boxed, etc.), and how the food will be prepared by kitchen staff. These are important aspects of working with schools as a market opportunity.

4. **Build a network of Farm to School famers.** Explore working with other farmers to collectively pool or aggregate your products so that there is enough of a supply available for schools divisions. Schools often require a large volume of products for their school meals. You may or may not be able to provide enough supply. If you cannot fill a complete order, we suggest working with other nearby farmers to aggregate enough product to meet the needs of a particular school division or distributor.

5. **Become familiar with school food procurement regulations.** Purchase the necessary policies and insurances so that you are in compliance with school food procurement regulations. This may mean increasing your insurance coverage. Weighing the costs and benefits of working with schools as a market opportunity is an important step to working with schools.

6. **Know which food safety best practices are right for you**. Think about becoming Good Agricultural Practices (GAP) certified. Schools may ask you to become GAP certified as a preventive measure to ensure food safety. Some distributors will only purchase from farmers who are GAP certified. We suggest contacting your local Extension agent to discuss the pros and cons of GAP certification.

7. **Talk with your school nutrition director or VCE professional about the school nutrition menu planning process.** Educate yourself about school nutrition menu planning and procurement regulations and current practices. This will allow you to more effectively communicate with school nutrition directors when discussing how they purchase food for their school meals.

Checklist for Farmers: Working with Schools on Farm to School

When working with school nutrition directors or food distributors to deliver your products to schools, we recommend that you develop a strong relationship with each perspective buyer/ handler and initiate an open line of communication. Below are a series of questions we suggest asking school nutrition directors or food distributors when starting to sell local and regional foods as part of a Farm to School program.

1. What types of products are you interested in purchasing? How much would you be interested in purchasing?

2. What is your pricing structure for (each product)?

3. Do you require delivery of products? How many different locations would you like for delivery of products to?

4. What type of condition do you prefer when obtaining products? Washed, boxed, sliced etc.?

5. How long do you typically take for payment/ reimbursement? Do you require an invoice?

6. Do you require Good Agricultural Practices (GAP) certification from farmers?

7. Would you like to tour my farming operation or sample my locally-grown products?

Recommendations for Food Distributors

Food distributors are an important stakeholder when it comes to developing a vibrant Virginia Farm to School Program. They are an essential group to help connect school divisions with locally and regionally-grown foods and farmers reach schools as a market opportunity. Below are a few recommendations we suggest when working with a food distributor.

Recommendations for Food Distributors When Working with Schools

1. **Know local and regional food preferences.** Ask each school division that you work with which types of locally and regionally-grown foods they would like to purchase.

2. **Demonstrate flexibility with quantity in local and regional food sales.** If at all possible, be open to distributing smaller quantities of locally and regionally-grown foods compared to non-locally or regionally-grown foods.

3. **Key stakeholder appreciation.** Appreciate the opportunity you can play in connecting farmers and their products to school meal programs.

Recommendations for Food Distributors When Working with Farmers

1. **Quality matters**. Be prepared to pay a little more for locally and regionally-grown foods. In some instances, locally and regionally-grown foods may cost a little more than non-locally-grown foods.

2. **Think outside of the box.** Be prepared to receive farm products that may be packaged differently than typical foods. Have a conversation about how each of your packaging needs can be met.

3. **Be prepared for farmers to ask you to come to their farm to pick-up their products**. This may or may not work for your company. Consider the options! Be open to the possibility of farmers asking to pick-up from their farm operation.

Recommendations and Considerations for Virginia Cooperative Extension Professionals and other Agricultural Educators

Farm to School programs are designed to give farmers another economic development opportunity to market their products to nearby school divisions for school lunches, snacks, and other school food and nutrition programs. They are also designed to give students greater access to healthy local and regionally grown/raised foods. This win-win approach has been a hallmark theme that has helped develop Farm to School across the U.S.

As individuals who are dedicated to supporting Virginia's agricultural industry and improving student access to healthy foods, agricultural service providers and Virginia Cooperative Extension agents have the opportunity to play a central role in strengthening Virginia's Farm to School Program. Through a 2011 survey of Virginia school nutrition directors, respondents stated that they were familiar with many Virginia agricultural and local food service providers. School nutrition directors stated that they were most familiar with Virginia Cooperative Extension, followed by the *Virginia Grown* Program, National Farm to School Network, *Buy Fresh Buy Local*, local food hubs, and local marketing campaigns. The following recommendations have been developed to help Virginia Cooperative Extension agents and other agricultural service providers continue to support the Virginia Farm to School Program.

Five Steps to Starting a Farm to School Program:

1. Assess where you are and where you would like to be.
2. Form a team and collaborate.
3. Establish one or two attainable goals.
4. Learn from others.
5. Promote Farm to School in your school and community.

These steps were developed by the National Farm to School Network. More information about these steps and getting started with Farm to School can be found online.

National Farm to School Network:Getting Started with Farm to School Publication
http://www.farmtoschool.org/files/publications_494.pdf

1. **Facilitate the Farm to School connections.** Educate your stakeholder groups about the Virginia Farm to School Program. Whether you work with farmers, industry groups, school system groups, health associations, or other community-based organizations, we recommend that you inform these individuals and groups about the Virginia Farm to School Program.

2. **Learn how VCE programs compliment Farm to School.** Educate yourself about the potential benefits, challenges, and opportunities to supporting the Virginia Farm to School Program. Three great websites that can help you learn more about Farm to School are the Virginia Farm to School Program website (http://www.vdacs.virginia.gov/marketing/farm.shtml), the National Farm to School Network website (http://www.farmtoschool.org), and the USDA Farm to School Program website (http://www.fns.usda.gov/farmtoschool). While exploring the Virginia Farm to School Program website you can learn which local schools in your community or region are interested in buying Virginia-grown and other local or regionally-grown foods. This website also provides information about how you can support the annual Virginia Farm to School Week.

3. **Become familiar with school food procurement regulations.** Educate yourself and have a basic understanding of current school nutrition menu planning and purchasing regulations and practices. This will allow you to more effectively work with both school nutrition directors who are exploring purchasing local and regional foods and farmers who are exploring selling to local and regional foods to schools.

4. **Get involved with Farm to School activities**. There are a number of ways for Virginia Cooperative Extension to get involved with local efforts. These include helping local and regional farmers connect to schools as a new marketing opportunity, helping schools develop school gardening programs, asking farmers to be part of school presentations to students to learn about local agriculture and food production, coordinating local food and nutrition education classes and taste tests in schools, or teaching food perseveration classes so more local food products are available year-round.

5. **Promotion and outreach for your county and region.** Ask your local newspaper and/or television station to do a story on a local Farm to School event. A 2011 survey of Virginia school nutrition directors found that one of the top potential benefits of Farm to School programs was that they enhanced the school division public relations. With your support, both you and the school system can receive positive media attention while increasing awareness of local agriculture and food production.

6. **Locate national Farm to School programming opportunities**. There are many great resources throughout the U.S. that are available about Farm to School. We recommend connecting with both national and other states resources to learn more about Farm to School. These resources can be utilized when developing local or regional Farm to School programs or when looking for research to support your involvement in Farm to School. Both the National Farm to School Network and USDA Farm to School Program websites are great starting points.

7. **Be the glue for Farm to School program growth**. Work with local agriculture, food, and school system stakeholders as a resource when they may be applying for a USDA Farm to School Grant. The USDA Farm to School Grant Program can be a great way to plan or implement local and regional Farm to School programs. Your involvement can bring different stakeholders together to apply for this grant. You may also be able to receive funding or additional resources through their Farm to School grant application to assist with local or regional Farm to School activities or programming efforts.

Kenner Love, Rappahannock County Extension Agent, supporting a local Farm to School program.

Key Farm to School Resource Organizations

Virginia Farm to School Resource Organizations

When developing local and regional Farm to School programs in Virginia, it is important to partner and collaborate with others organizations and groups that can support your efforts. Below is a list of organizations that have been involved with supporting Farm to School programs and activities, and that you may want to contact for additional information, resources, and support.

Virginia Department of Agriculture & Consumer Services

The Virginia Department of Agriculture and Consumer Services is charged with coordinating the Virginia Farm to School Program. VDACS manages the official Virginia Farm to School Program website and also serves a resource to answer questions about Farm to School in Virginia. The Virginia Farm to School program is an effort to increase the amount of fresh and nutritious Virginia Grown products offered in schools and to promote opportunities for schools and local farmers to work together. Ms. Leanne Dubois currently serves as the Virginia Farm to School Coordinator and can be reached by email at leanne.dubois@vdacs.virginia.gov or by phone at (804) 225-3663.

Virginia Department of Education

The Virginia Department of Education is charged with administering the school nutrition program in Virginia. Through this effort they help coordinate the National School Lunch Program, School Breakfast Program, afterschool snack programs, the Fresh Fruit and Vegetable Program, and the Summer Food Service Program. Through school nutrition programs, 681,505 lunches, 196,987 breakfasts and 7,240 afterschool snacks are served on a typical day in Virginia public schools (Virginia Department of Education, 2013). The Director of the School Nutrition Program, Ms. Catherine Digilio Grimes has been a strong supporter of the Virginia Farm to School Program. Catherine can be reached by email at Catherine.Digilio-Grimes@doe.virginia.gov or by phone at (804) 225-2074.

Virginia Cooperative Extension

Virginia Cooperative Extension brings the resources of Virginia's land-grant universities, Virginia Tech and Virginia State University, to the people of the commonwealth. Virginia Cooperative Extension is a dynamic organization that stimulates positive personal and societal change, leading to more productive lives, families, farms, and forests as well as a better environment. Extension programs are delivered through a network of faculty at two universities, 107 county and city offices, 11 agricultural research and Extension centers, and six 4-H educational centers. Virginia Cooperative Extension has been active in supporting the Virginia Farm to School Program. Local Extension agents are a good resource to help connect local foods to local school nutrition programs and identify other resources available to develop local and regional Farm to School programs. More information about Virginia Cooperative Extension can be found at their website, http://www.ext.vt.edu.

Virginia Agriculture in the Classroom

The Virginia Agriculture in the Classroom Program is coordinated by the Virginia Farm Bureau. The Virginia AITC Program is a statewide educational program that provides teachers with staff development and resources designed to bring Virginia's Standards of Learning alive through real-world applications. AITC helps teachers integrate the study of Virginia agriculture and natural resources into their curriculum. The mission of AITC is to educate Virginia's children about the importance of agriculture. AITC has been a long-time supporter of the Virginia Farm to School Program, and can be called on to provide educational resources about Virginia food production and agriculture for school teachers or provide professional development opportunities for Virginia's educators about Virginia food and agriculture. For more information about the Virginia AITC Program, please contact Tammy Maxey at tammy.maxey@vafb.com or visit their website, http://www.agintheclass.org.

Virginia Farm Bureau

Virginia Farm Bureau is a lead organization promoting agriculture in Virginia. It works with policymakers to create an environment where agriculture can prosper and improve the lives of all Virginians. The staff of the Virginia Farm Bureau Commodity and Marketing department continues to help strengthen Virginia's local and regional food systems through technical assistance, speaking at educational programs, and supporting food system initiatives that help Virginia farmers connect to Virginia's markets. For more information about Virginia Farm Bureau is available online at their website, https://vafarmbureau.org.

Virginia Food System Council

The Virginia Food System Council is a board of 24 volunteer directors, representing all aspects of the food system from local producers and consumers, social justice and environmental non-profit organizations, to dietitians and statewide organizations. The Virginia Food System Council envisions a sustainable food system contributing to the health, economic vitality and social well-being of all Virginians by working to advance a nutrient-rich and safe food system for Virginians at all income levels, with an emphasis on access to local food, successful linkages between food producers and consumers, and a healthy viable future for Virginia's farmers and farmland. Their board members may be a resource for you when developing or expanding your Farm to School programs. For more information, please visit their website, http://virginiafoodsystemcouncil.org.

Virginia Foundation for Agriculture Innovation and Rural Sustainability

The mission of the Virginia Foundation for Agriculture Innovation and Rural Sustainability is to "assist rural Virginians in developing and advancing their agricultural, economic, and social interests to enhance their quality of life." As part of its mission, its goal is to "offer assistance in rural areas to promote cooperative and business development." VA FAIRS has supported the development of the Virginia Farm to School Program through helping fund educational programs and strategic planning meetings since its beginning. It also provides business development consultation and assistance for several entities involved with Farm to School in Virginia and may be a resource for helping you market and distribute local foods to Virginia school divisions. Mr.

Chris Cook is the executive director of FAIRS and can be reached by phone at (804) 290-1111 or by email at ccook@vafb.com. More information about FAIRS is available at their website, http://www.vafairs.com.

Virginia FFA Association & Virginia Association of Agricultural Educators

The Virginia FFA (Future Farmers of America) Association and Virginia Association of Agricultural Educators are two organizations that support agricultural education at public schools across Virginia. You may want to contact individuals at these organizations for help introducing agricultural education in schools or growing local foods through school garden and greenhouse activities. For more information about the Virginia FFA, visit their website, http://www.vaffa.org. For more information about the Virginia Association of Agricultural Educators, visit their website, http://www.aee.vt.edu/vaae/VAAE-index.html.

Lulu's Local Food

Lulu's Local Food is an organization that helps entrepreneurs start food hubs that connect farm products from small and medium sized farms to household, retail, and institutional markets. It does so by developing an online farmer's market system where customers can purchase foods from Virginia-based farmers. In Virginia, Lulu's is the parent company of four local food hubs including Local Roots Food Co-op, Fall Line Farms, Coastal Farms, and Mountain Foods. Lulu's Local Food Hub has been a long-time supporter of the Virginia Farm to School Program and has connected Virginia famers to school divisions and their cafeterias across the Commonwealth. More information about Lulu's Local Food can be found at their website, http://www.luluslocalfood.com.

The Local Food Hub

Local Food Hub is an innovative non-profit based in Charlottesville, Virginia working to connect farms, families, and food grown close to home. Local Food Hub provides aggregation, distribution, and marketing services that enable institutions, schools, and hospitals to easily access and purchase fresh, locally grown food. Local Food Hub works with 75+ farmers who produce fruits, vegetables, meat, eggs, and value-added goods in wholesale quantity and quality. By creating "one number to call" for local food and working closely with cafeteria managers and school nutritionists, Local Food Hub has removed institutional barriers to purchasing local. Today, Local Food Hub delivers fresh local food on a weekly basis to more than 50 public and private K-12 schools and universities in Central Virginia. Local Food Hub has also created a unique "'bridging the gap" program that leverages donations from community members to help offset the higher price of certain local foods for school meals (for example, ground beef). This, along with in-school tastings, educational materials, and local food delivery, is part of Local Food Hub's effort to support the annual Virginia Farm to School Week. More information about Local Food Hub's involvement in the Virginia Farm to School Program, visit their website, http://localfoodhub.org.

Other Virginia-based Local Food Hubs

There are several other Virginia-based local food hubs that help farmers aggregate their products together for increased supply and distribution of local foods. They food hubs are scattered throughout the state and may be able to help school divisions find the supply needed for a local Farm to School program. Virginia-based local food hubs that can be called on to help fill a Farm to School order can be found at the USDA Food Hub website, http://www.ams.usda.gov/AMSv1.0/foodhubs.

National Farm to School Resource Organizations

National Farm to School Network

The National Farm to School Network envisions a nation in which Farm to School programs are an essential component of strong and just local and regional food systems, ensuring the health of all school children, farms, the environment, economy and communities. The National Farm to School Network supports the implementation of Farm to School in all 50 states and the District of Columbia through focused work in the following priority areas: 1) policy development; 2) training and technical assistance; 3) information development and dissemination; 4) networking; 5) media and marketing; and 6) research and evaluation. Their network includes national staff, eight regional lead agencies, 50 state leads who serve as local points of contact for information and resources, and thousands of Farm to School advocates and community leaders from all over the country.

Based in Philadelphia, Pennsylvania at The Food Trust is the National Farm to School Network Regional Lead for the mid-Atlantic region. More information about the National Farm to School Network is available at their website, http://www.farmtoschool.org.

USDA Farm to School Program

The USDA Farm to School Team includes national staff and seven regional staff across the U.S. These individuals are available to help facilitate implementation of Farm to School programming and answer any questions you may have about the USDA Farm to School Grant Program or federal policies and regulations governing the purchasing of local foods by Virginia school divisions. The USDA Farm to School team works in conjunction with several individuals in each state including those at the Virginia Department of Agriculture and Consumer Service and Virginia Department of Education. State-based Farm to School contacts can be found online, http://www.fns.usda.gov/cnd/f2s/contacts.htm. The National Director can be reached by email at farmtoschool@fns.usda.gov. For more information about the USDA Farm to School team and USDA Farm to School Program visit their website, http://www.fns.usda.gov/farmtoschool.

Virginia Farm to School Profiles

Across Virginia, many diverse farmers and special school nutrition directors are supporting the Virginia Farm to School Program by selling or buying local and regional foods for inclusion in school meals. Below are a few profiles of these hardworking individuals who are helping farmers access new markets and students enjoy fresh, local foods.

School Nutrition Directors

Harrisonburg City Public Schools
Andrea Early – Director of School Nutrition

Our Farm to School program was initiated during the 2007-2008 school year. What began with lettuce purchases from a local farmer has expanded to 8-10% of total food dollars being spent each school year on locally grown and produced foods. Initially our program's focus was on inclusion of local products on lunch menus, but efforts have expanded to include more educational opportunities including farm visits, classroom education through the USDA Fresh Fruit and Vegetable Program, and school gardens at two elementary schools.

As we moved forward with Farm to School, we were met with the typical challenges – price, distribution, and labor needed to prepare local foods. These challenges have been met through what I would call a hodge-podge approach. Many of the local foods purchased cost a bit more than their conventional counterparts, but we have been able to absorb these costs through increasing participation and by cooperative purchasing for the majority of our food and supplies. Distribution is accomplished through our standard distributors and by direct deliveries to schools by farmers. Our maintenance staff has been a vital component in deliveries from a central school to all other schools. By menuing local foods alongside less labor intensive items, we are able to serve local products without significant increases in labor costs.

Partnerships have been an important part of our Farm to School success. Participation in our area's local foods workgroup allowed us to make connections with local farmers and producers and to get our interest in purchasing locally "out there". An area non-profit group has helped to initiate and support our school gardens. Virginia Cooperative Extension has developed nutrition education materials for use in our Fresh Fruit and Vegetable Program.

My continued advice to those who are interested in initiating a Farm to School program is to start small so that it is not overwhelming. If you are interested in including local food in school meals, look at your existing menu to see if there are one or two items that might be available locally at a price you can afford. If education is your initial focus, find a teacher or two who may be interested in doing container gardens with students. Expand your program at a pace that is comfortable for all involved. Celebrating small successes will guarantee that your program will continue to grow!

Goochland County Public Schools
Lisa Landrum – Supervisor of School Nutrition

We began planning in December 2008 and implemented our first "local purchase" in March of 2009. Since that time we have gone from serving a *Virginia Grown* item monthly on our lunch menu to serving a *Virginia Grown* item daily. We have expanded to our breakfast program as well with fresh seasonal fruit and sausage.

Partners from past and present include our local Extension office, a local foods co-op and a host of local farmers.

I would like to highlight our Farm to School Week menu. At least one day of the annual Farm to School Week, we serve a complete local menu with our entrees consisting of grass-fed beef and pork, seasonal veggies and fruit (usually Fuji and Red Delicious apples- YUM!). I feel like every day that we can bring really fresh food to our students is a great success.

There have definitely been challenges. This includes things from purchasing practices to delivery followed by packaging, pricing, availability and staff training. My best advice would be to contact your state lead or the VDACS Farm to School Coordinator when you hit a roadblock. Don't give up! Someone in the state has met these challenges and can help you.

My hope for the Virginia Farm to School Program is to get all school districts participating. I think one of the best ways to accomplish this is to get more distributors and farmers connected. This would take a lot of the "guesswork" out of the mix as well as make the whole process flow more smoothly.

Rappahannock County Public Schools
Trista Grigsby – Director of Nutrition Services

Planted at Rappahannock County High School in 2004, the Farm-to-Table (F2T) program has branched out and now provides fertile soil for learning to students in both classrooms and cafeterias throughout the district.

Through F2T, students gain an appreciation of Rappahannock County's agrarian culture and how agriculture, food, and nutrition are inter-related elements of wellness. The program helps students make the connection between what they choose to eat, how it gets to their tables, and how food affects their health and the health of the community.

Farm-to-Table is a partnership between Headwaters, Rappahannock County Public Schools, and other community organizations such as the Rappahannock County Farm Bureau, Virginia Cooperative Extension, Piedmont Environmental Council, Williams Orchard, and Waterpenny Farm. Generous support from several local family foundations funds the school gardens' creation and maintenance, the seasonal and local food tastings, and the hiring of student interns in the summer. Waterpenny Farm administers the "Food For Thought" fund, which helps offset the cost of purchasing local foods for school cafeterias. In addition, Waterpenny Farm grows food especially for school purchase and sells items such as cosmetically blemished butternut squash at an affordable price to the schools.

Since 2006, F2T has sponsored 18 seasonal, local food tastings in cafeterias. This collaboration brings volunteers, farmers, culinary arts students, horticulture students, and cafeteria staff together to educate students about nutritional content, the value of trying new foods, and how delicious real food can taste. When students take recipe cards home with local vendor information, the demand for good food hits home. And it works: one student demanded beets and parsnips after trying the roasted root vegetables. A fourth grader said "I usually don't eat beets, but these are awesome! I want more leaves. I feel like a brachiosaurus!"

Over 4,000 pounds of produce has been grown by students in the school gardens using organic methods. About half of this produce has been used in the school cafeterias and about half has gone to the Rappahannock Food Pantry, to the students themselves, and to special community events.

The program has matured to provide education in the classrooms and cafeterias. Using student-grown food and promoting it with point-of-sale materials and student ambassadors has helped increase salad sales. Meeting food safety guidelines when using student-grown food in the school

cafes proved to be a challenge. Additionally, building the gardens was not enough to get teachers interested in using them. It took buy-in at the administrative level, integration with classroom SOL objectives, parent support, and student enthusiasm to cultivate a successful multi-disciplinary approach to learning about food, farming, and nutrition in schools.

This year, 12.6% of the total produce purchased for the school cafeterias was grown locally. As recipients of a USDA Farm to School planning grant in conjunction with Page and Orange County schools, the goal is to increase local food use by 5% next year and to 25% in five years. With increased food costs due to National School Lunch Program guidelines and existing budget constraints, the increased cost of local foods seems like it could be a stumbling block. However, there are other ways to save money in cafeteria operations. Reducing disposable product purchases, increasing efficiency through skills training and proper equipment use, and buying products during peak season at lower prices and freezing or processing for later use are examples of ways to make local food purchases a financially sound decision. If these efforts create healthy, nutritionally savvy students and a more sustainable local food system, the extra effort is worth it.

Trista Grigsby and students enjoying some tasty local food!

Farmers

David Sours – Public House Produce

We began by providing Page County Schools with 6-7 dozen eggs per week. This was a small start, which allowed us to establish a working relationship with Diane Dovel, the Page County Public Schools (PCPS) Food Service Director. We began providing items from our farm like lettuce, spinach, and kale. Currently, we grow several additional items for the school as well as aggregate other crops from local farmers year round.

David and Heather Sours taking a stroll on their farm

Our relationship with the Page County School system has been fostered by our involvement with Page County Grown. This organization has allowed relationships to develop between PCPS and Page County farmers. During many of the Page County Grown meetings, other farmers expressed that delivering to PCPS was difficult due to their off farm employment. This allowed us the opportunity to aggregate products other farms in our county and the Shenandoah Valley.

I am very proud of the accomplishments of the Page County Farm to School Program. It's hard to believe that we started with six dozen eggs a week and then moved to 50-60 lbs. of spinach and now we are providing PCPS with all of their eggs and apples as well as other produce. The biggest success came this past school year when we were told that PCPS was leading the state of Virginia in the percentage of local foods used in their system. PCPS sourced 37% of the produce they used in the 2012-2013 school year locally. That is a big number and we are very proud of this achievement! We hope this percentage will continue to grow so that children receive even more fresh, local produce.

Starting something new takes time and persistence. It was frustrating in the beginning, but with open communication and quality products we eventually made headway with getting our produce into school meals. Distribution was an issue in the beginning due to the small orders. However, with some special Farm to School days that featured local foods and with the help of students requesting more local foods things began to change. Once the children noticed a difference and were telling their teachers, families, and most of all the cafeteria staff, that is when things started to change. So my advice is to start small with a few items, get those items in front of the children, keep your head down, work hard and the rest will come!

We have worked very hard to get our produce in PCPS. This success has helped our farm expand and we plan on being able to provide additional items for PCPS this coming school year. It is also very rewarding to see children in our county enjoying eating locally grown foods and it's great to hear them tell everyone how much better the vegetables taste. With the support of our community, school system, and the local farms, I believe the sky is the limit for local foods in Page County.

David and Heather Sour's daughter and her chicken "Sugar"

Chris and Sarah Guerre – Maple Avenue Market Farm

The 2013-2014 school year will be the fifth year that Chris and Sarah Guerre of the Maple Avenue Farm Market sell locally-grown foods to Arlington County Public Schools as part of the Arlington County Farm to School Program. Since the beginning, coordinating and participating in the Farm to School program has been a rewarding experience for Chris and Sarah, as well as Amy Maclosky, the director of school nutrition for Arlington County. Maple Avenue Farm Market, (historically known as Hidden Springs Farm) is located in Great Falls, Virginia, and is one of very few working farms in the area.

A mutual friend who was serving on the Arlington County Food Service Advisory Committee first initiated the connection by helping introduce Chris and Sarah to Amy. Maple Avenue Farm Market sells a wide variety of organically-grown fresh produce to Arlington County schools including different types of lettuces, carrots, beets, kale, broccoli, cauliflower, tomatoes, radishes, and turnips. They also sell different colored eggs and edible flowers to Arlington County schools. The blue, green, and brown colored eggs are a

favorite of the students. Schools are one of three markets for Maple Avenue Farm Market. Chris and Sarah also sell their produce and other farm products at nearby farmers markets, and their retail store located in Vienna, Virginia. During the 2012-2013 school year, approximately 30% of all of the produce that Arlington County Public Schools purchased was from local farmers.

Chris and Sarah Guerre not only sell their locally-grown foods to Arlington County but also spend time in schools such as Jamestown Elementary helping students learn about local food production and the importance of eating fresh locally grown foods. This has been extremely rewarding for them and the students! They believe that farm-based education is helpful for Farm to School programs to go beyond just serving local foods. One major success for them has been seeing student's excitement in going back for two and three servings of lettuce and eating more salad than they thought any student would (or could) consume.

Chris and Sarah recognize that price can be a challenge for some farmers who would like to work with schools as a market and suggest finding innovative solutions as soon as possible when such challenges present themselves. A long-term challenge that Chris and Sarah experience is trying to change the habits and behaviors of students so they eat healthy food for their entire life and make it part of their regular diets. However, they are committed to making sure that students in Arlington County have access to fresh local food through Farm to School!

Amy Maclosky (center), director of school nutrition for Arlington County Public Schools talks with Chris and Sarah Guerre at their Maple Avenue Market Farm. The fields behind them will produce much of the locally grown foods that Amy purchases for the 2013-2014 school year.

Glossary of Farm to School Terms

Aggregation: The collection of agricultural products from a number of area farms at a central hub. Delivery to customers from an aggregation hub can be more efficient than point-to-point distribution from farms to customers.

Cash Reimbursements: The money USDA provides schools to help pay for the cost of school meals. During the 2012-2013 school year, schools received $2.92 for each free lunch served, $2.52 for a reduced-price lunch and $0.33 for each full price lunch sold.

Farm to School: A program that connects schools (K-12) and local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing agriculture, health and nutrition education opportunities, and supporting local and regional farmers (National Farm to School Network, 2013).

Food Hub: A centrally located facility with a business management structure facilitating the aggregation, storage, processing, distribution, and/or marketing of locally/regionally produced food products. [xxi]

Good Agricultural Practices: More commonly referred to GAPs. A set of recommendations that can help improve the quality and safety of the produce grown. These general guidelines can be adapted and/or incorporated into any production system. GAPs focus on four primary components of production and processing: soil, water, hands, and surfaces. [xxii]

Geographic Preference: A ruling that allows institutions receiving funds through the Child Nutrition Programs to apply an optional geographic preference in the procurement of unprocessed locally grown or locally raised agricultural products. According to the final rule, the definition of "unprocessed" means those agricultural products that retain their inherent character. [xii]

Hazard Analysis and Critical Control Points (HACCP): A system which identifies, evaluates, and controls hazards which are significant for food safety.

HACCP Plan: A document prepared in accordance with the principles of HACCP to ensure control of hazards which are significant for food safety in the segment of the food chain under consideration.

Local Food: There is no generally accepted definition of local food. In a 2011 survey of Virginia school nutrition directors, the majority of respondents believed that local food included "food raised or produced within Virginia." With passage of the 2008 Farm Bill, Congress defines local food as a food product that is consumed less than 400 miles from where it was produced or consumed within the state it was produced. [xxiii]

Meals/Labor Hour: A measure of efficiency for school nutrition programs. A lower number is acceptable if a greater number of raw or unprocessed items are included.

National School Lunch Program: A federally assisted meal program operating in public and nonprofit private schools and residential child care institutions. It provides nutritionally balanced, low-cost or free lunches to children each school day. The program was established under the National School Lunch Act, signed by President Harry Truman in 1946. [xxiv]

New Meal Pattern: A new set of school meal requirements for school nutrition directors participating in Child Nutrition Programs developed and implemented because of the 2010 Healthy Hunger Free Kids Act.

Procurement: The act of buying food for a school lunch program.

USDA Foods (i.e. commodities or entitlements): Foods that the USDA provides to schools to use for breakfast and lunch programs. These foods typically make up 15-20% of each school lunch. Schools are entitled to receive 22.25 cents for each lunch meal served.

Photo courtesy of USDA Farm to School Program

Appendix

Virginia Farm to School Program Resources

Virginia School Nutrition Program
http://www.doe.virginia.gov/support/nutrition/index.shtml
This website provides information about the Virginia School Nutrition Program as well as contact information to the state director and other state personnel.

Local School Nutrition Program Contacts (By School Division)
http://www.doe.virginia.gov/support/nutrition/resources/nutrition_programs_dir.shtml
This website provides contact information for each of local school nutrition directors. Farmers may want to visit this website as way to help communicate with nearby Virginia school nutrition directors.

Virginia Grown
http://www.vdacs.virginia.gov/vagrown
This website provides information about Virginia grown farm products and includes a search engine that allows users to search by farm type, product, and location. This website can help food distributors and school nutrition directors locate possible sources of Virginia Grown foods.

Virginia Buy Fresh Buy Local Program
http://www.buylocalvirginia.org
This website provides information about Virginia farmers who produce local food for school meals as part of a local or regional Farm to School program. You can search for local food by product category, farm type, marketing outlet, or location.

Virginia Grown Farm to School Product Availability Calendar
http://www.vdacs.virginia.gov/marketing/pdf/farmproducechart.pdf
See page 35 and 36 of the resource guide to view the full calendar.

Virginia Farm to School Recipes
There are a large variety of Virginia grown/raised foods that can be included in local and regional Farm to School programs. In 2010, the Virginia Food Systems Council documented that 36 different Virginia foods were included in the 2009 Virginia Farm to School Week. [xvii]

Through a survey of local school nutrition directors, respondents were asked to list which Virginia grown/raised foods they had included in school meals. Below is the list of the reported products.

Table 1. *List of Products Sold or Purchased for the Virginia Farm to School Program*

Fruits	**Vegetables**		**Meats**	**Other Foods**
Apples	Broccoli	Onions	Chicken	Butter
Blackberries	Cabbage	Peppers	Beef	Cheese
Cantaloupe	Carrots	Radishes	Pork	Eggs
Honeydew	Collard greens	Spinach		Flour
Nectarines	Cucumbers	Squash		Milk
Peaches	Eggplant	Sweet potatoes		
Strawberries	Green beans	Turnips		
Tomatoes	Kale	White potatoes		
Watermelon	Assorted lettuces	Winter squash		

Virginia Local Foods Cookbook
http://www.pubs.ext.vt.edu/3001/3001-9027/3001-9027.html
Virginia Cooperative Extension has compiled a local foods cookbook featuring recipes that can be made using local foods. This resource cookbook can be downloaded from the Virginia Cooperative Extension website under "Publications and Educational Resources" or by clicking on the Extension Homepage quick link Community Food Systems under "Foods, Nutrition, and Health".

Kidchen Expedition: Oklahoma Farm to School Cookbook
http://www.kidchenexpedition.com
The Oklahoma Farm to School Program has put together a wonderful resource for school food professionals and other individuals interested in using local and regional foods in school meals. It includes different sections by product type as well as information about food safety and other Farm to School tips.

The 2013 Healthy Lunchtime Challenge Cookbook
http://www.recipechallenge.epicurious.com
This cookbook features 54 winning recipes from the America's junior chefs and presented at the second annual Healthy Lunchtime Challenge & Kids' "State Dinner." First Lady approved!

Virginia Food Safety Information

Farm Self Help Form
http://www.pubs.ext.vt.edu/FST/FST-35/FST-35NP_PDF.pdf
This is a great resource for farmers interested in inventorying their on-farm food safety practices or school nutrition directors and food distributors interested in learning more about a farms on-farm food safety practices.

Training and Certification Options
http://www.pubs.ext.vt.edu/FST/FST-44/FST-44NP_PDF.pdf
This is a great resource for farmers selling locally and regionally-grown foods who are considering additional training and certifications in food safety including Good Agricultural Practices certification.

Transporting Produce Safely
http://www.pubs.ext.vt.edu/FST/FST-43/FST-43_PDF.pdf
This is a great resource for food distributors who would like more information about transporting produce safely to ensure food safety standards, prevent contamination, and minimize the growth of harmful organisms.

Additional food safety materials and resources can be found on Virginia Cooperative Extension's website, http://www.pubs.ext.vt.edu/category/food-safety.html.

Garden-Related Curriculum Resources

The Great Garden Detective Adventure: A Standards-Based Gardening Nutrition Curriculum for Grades 3 and 4
http://teamnutrition.usda.gov/Resources/gardendetective.html
Discover what fruits and vegetables are sweetest, crunchiest, and juiciest through a series of investigations and fun experiences connecting the school garden to the classroom, school cafeteria, and home. This eleven-lesson curriculum for 3rd and 4th grades includes bulletin board materials, veggie dice, fruit and vegetable flash cards, and ten issues of Garden Detective News for parents/caregivers.

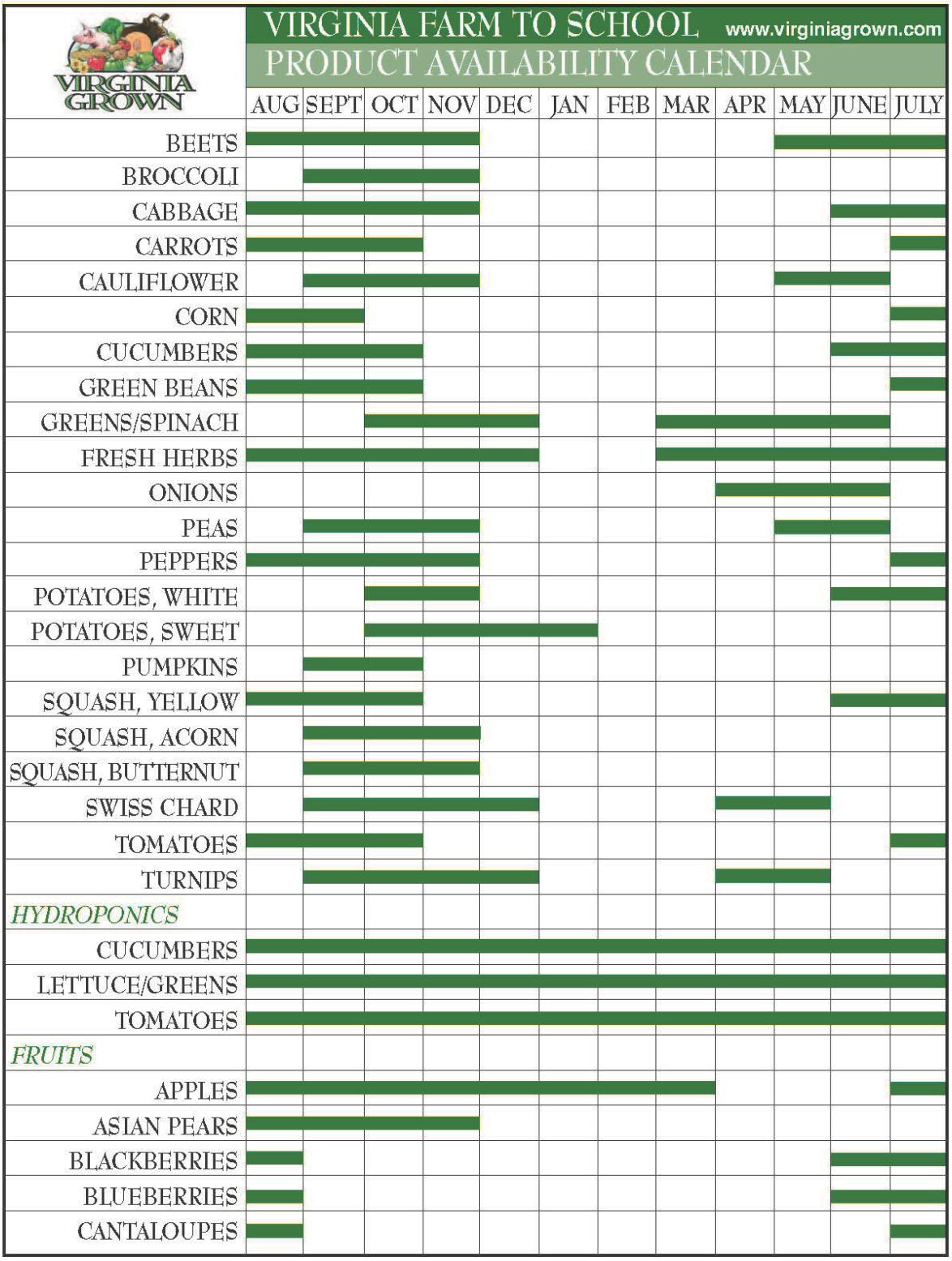
Dig In! Standards-Based Nutrition Education from the Ground Up for Grades 5 and 6
http://teamnutrition.usda.gov/Resources/dig_in.html
Explore a world of possibilities in the garden and on your plate using ten inquiry-based lessons that engage 5th and 6th graders in growing, harvesting, tasting, and learning about fruits and vegetables.

Other Farm to School Resources

Farm to School Showcase Toolkit
http://www.ecotrust.org/farmtoschool/showcase-toolkit.php
Ecotrust has developed this guide for connecting local food suppliers with school food buyers at school nutrition tradeshows.

USDA Farm to School Resources and Fact Sheets
http://www.fns.usda.gov/farmtoschool
The USDA Farm to School Program has compiled a series of resources to assist schools and school districts in implementing Farm to School programs. The USDA has also developed a series of fact sheets to help connect schools with more local foods.

Virginia Grown Farm to School Product Availability Calendar



VIRGINIA FARM TO SCHOOL www.virginiagrown.com

PRODUCT AVAILABILITY CALENDAR

	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY
GRAPES	■	■	■								■	■
RASPBERRIES	■	■	■									
PEACHES	■	■										■
PEARS	■	■	■	■								■
STRAWBERRIES									■	■	■	
WATERMELONS	■	■										■
AVAILABLE ALL YEAR												
BEEF	■	■	■	■	■	■	■	■	■	■	■	■
CHEESE	■	■	■	■	■	■	■	■	■	■	■	■
CHICKEN	■	■	■	■	■	■	■	■	■	■	■	■
EGGS	■	■	■	■	■	■	■	■	■	■	■	■
HONEY	■	■	■	■	■	■	■	■	■	■	■	■
ICE CREAM	■	■	■	■	■	■	■	■	■	■	■	■
LAMB	■	■	■	■	■	■	■	■	■	■	■	■
MILK	■	■	■	■	■	■	■	■	■	■	■	■
MUSHROOMS	■	■	■	■	■	■	■	■	■	■	■	■
PEANUTS	■	■	■	■	■	■	■	■	■	■	■	■
PORK/HAM	■	■	■	■	■	■	■	■	■	■	■	■
SEAFOOD	■	■	■	■	■	■	■	■	■	■	■	■
TURKEY	■	■	■	■	■	■	■	■	■	■	■	■
YOGURT	■	■	■	■	■	■	■	■	■	■	■	■

This chart shows approximate harvest periods. Harvests may vary by region and weather conditions.

VIRGINIA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

FARM TO SCHOOL PROGRAM
102 Governor Street, Richmond, Virginia 23219
Leanne DuBois
leanne.dubois@vdacs.virginia.gov, 804.225.3663, Fax: 804.371.7786
www.VirginiaGrown.com

Endnotes

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