

Specialty Crop Block Grant Agreement No. 12-25-B-0955

Final Report to USDA-Agricultural Marketing Service

Attn: Trista Etzig, Jenny Greer and John Miklozek
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Submitted by



AGENCY OF AGRICULTURE, FOODS & MARKETS

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PROJECT 1: Apple & Grape Industry Education Program**PROJECT SUMMARY**

Apples are an important agricultural commodity in Vermont’s rural communities and working landscape. Of all the different fruits grown and harvested for sale in Vermont, apples comprise approximately 91% of total acreage planted to fruit (USDA NASS, 2008). The apple industry generates jobs and supports communities and businesses across the State of Vermont and is an important part of the state’s diversified agriculture. Apple orchards are complex ecosystems that require intensive management to produce high quality fruit. Tree growth and fruit production are intricately affected annually by the diverse biotic and abiotic factors within the environment which include numerous insects, mites, plant pathogens, weeds, and vertebrates. Effective Integrated Pest Management (IPM) is critical in profitable and sustainable apple production. Vermont apple growers want up-to-date information on effective IPM practices and tools so that they can incorporate them into their pest management programs to reduce economic, health, and environmental risks. The VAA Specialty Crop Block Grant supported outreach and education to this important Vermont agricultural community.

Another important, emerging agricultural commodity in Vermont is cold climate winegrapes. The cold climate winegrape industry is rapidly expanding; it is a ‘new’ crop in Vermont and in the region

that offers significant value-added and agri-tourism economic opportunities. This emerging industry is at a critical stage in establishing production practices. With the continued expansion of new people who are starting winegrape vineyards with limited or no background in agriculture, it is imperative to provide effective outreach and education on IPM techniques and approaches that minimize economic, environmental, and health risks. The Specialty Crop Block Grant supported outreach and education to this important Vermont agricultural community.

PROJECT APPROACH

Outreach and education to Vermont's commercial apple and grape industries were accomplished through implementing the Scope of Work as outlined in the grant:

- (1) Collection of orchard and vineyard IPM data and other information for inclusion in apple and grape newsletters and websites,
- (2) Development and electronic distribution of apple and grape newsletters, with approximately 10 apple and 10 grape newsletters distributed during the period of the grant to address time sensitive issues, and
- (3) Development and implementation of apple and wine industry education and training workshops. Two workshops are planned to take place during the winter and / or growing season during the period of the grant.

Websites that were supported in part by this grant include:

- The Cold Climate Grape Production website: <http://pss.uvm.edu/grape/>
- UVM Apple Orchard website: <http://orchard.uvm.edu/>

Newsletters that were supported in part by this grant include:

- Berkett, L.P. 2010. *Cold Climate Grape IPM Updates*. 9 issues, 32 pp.
- Berkett, L.P. 2010. *Vermont Apple IPM Alerts*. 17 issues, 60 pp.
- Berkett, L.P. 2011. *Cold Climate Grape IPM Updates*. 15 issues, 36 pp.
- Berkett, L.P. 2011. *Vermont Apple IPM Alerts*. 21 issues, 54 pp.
- Berkett, L.P. 2012. *Cold Climate Grape IPM Updates*. 15 issues. 47 pp.
- Berkett, L.P. 2012. *Vermont Apple IPM Alerts*. 18 issues, 41 pp.

In 2012, the *Vermont Apple IPM Alerts* were disseminated to over 100 growers who subscribed to the Apple IPM email listserve, and archived on the Apple IPM website which had an additional 650 visits; the *Grape IPM Updates* were written and disseminated to over 200 growers who subscribed to the Grape IPM email listserve, and archived on the Cold Climate Winegrape IPM website which had approximately 800 additional visits.

Industry Workshops and Educational Events included:

- Apple Grower Meeting/Workshop - held in cooperation with the Vermont Tree Fruit Growers Association; Feb. 18, 2010; Middlebury, Vermont; ~ 60 attendees

- Vineyard Tour/Educational Event - UVM Horticulture Research Center, South Burlington, VT; August 20, 2010; ~115 attendees
- Apple Grower Meeting/Workshop - held in cooperation with the Vermont Tree Fruit Growers Association; Feb. 8, 2011; Middlebury, Vermont; ~ 60 attendees
- Apple and Vineyard Tour/Educational Event - UVM Horticulture Research Center, South Burlington, VT; August 19, 2011; over 100 attendees
- UVM Vineyard Field Day, UVM Horticulture Research Center, South Burlington, VT; August 23, 2012; ~ 32 attendees

GOALS AND OUTCOMES ACHIEVED

The outreach and education provided to commercial apple and grape growers over the grant period have consistently been highly evaluated by stakeholders and had positive outcomes and impacts. For example, the following are the outcomes/impacts from the most recent **apple survey results** from stakeholders:

- 100% of respondents reported practicing Apple IPM
- 100% of respondents reported that they found the IPM information provided by the Apple IPM Program (i.e., either the IPM Alerts, articles, presentations, website, and/or one-on-one education) useful with 78% reporting the information 'Highly Useful'.
- 100% of respondents said they used the IPM information provided in decision-making.

In addition, the following are the responses to other apple survey questions:

Has the information obtained through the UVM Apple IPM Program allowed you to:

Increase your knowledge or understanding of Apple IPM

Yes	No	Unsure
100%	0%	0%

Increase your knowledge on how to prevent pest management problems.

Yes	No	Unsure
100%	0%	0%

Adopt at least one new IPM practice

Yes	No	Unsure
88%	6%	6%

Reduce or minimize pesticide use

Yes	No	Unsure
83%	0%	17%

Determine if pesticides are needed in your orchard

Yes	No	Unsure
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83%	11%	6%
Effectively time pesticides if they were needed		
Yes	No	Unsure
100%	0%	0%

Adopt a reduced-risk alternative to manage a pest		
Yes	No	Unsure
71%	12%	17%

Have the IPM practices that you have implemented had an overall economic impact in your orchard operation?

Yes	No	Unsure
68%	0%	32%

If Yes, has the economic impact produced a:

Net economic benefit (i.e., benefit from better yield (quality and/or quantity) and/or reduce risks, etc.)	Net economic loss (i.e., cost outweighed any benefits)
100%	0%

Similarly, the cold climate winegrape outreach and education have been highly evaluated and also had positive outcomes and impacts. The following are the outcomes/impacts from the most recent survey results of from cold climate **grape stakeholders**.

- 95% of respondents reported practicing IPM
- 100% of respondents reported that they found the IPM information provided by the Cold Climate Winegrape IPM Program (i.e., either the IPM Updates, articles, presentations, website, and/or one-on-one education) useful with 83% reporting the information 'Highly Useful'.
- 91% of respondents said they used the IPM information provided in decision-making.

In addition, the following are the responses to other grape survey questions:

Has the information obtained through the UVM Grape IPM Program allowed you to:

Increase your knowledge or understanding of Grape IPM		
Yes	No	Unsure
100%	0%	0%

Increase your knowledge on how to prevent pest management problems.		
Yes	No	Unsure
96%	0%	4%

Adopt at least one new IPM practice		
Yes	No	Unsure
87%	9%	4%

Reduce or minimize pesticide use		
Yes	No	Unsure
70%	4%	26%

Determine if pesticides are needed in your vineyard		
Yes	No	Unsure
87%	9%	4%

Effectively time pesticides if they were needed		
Yes	No	Unsure
74%	9%	17%

Adopt a reduced-risk alternative to manage a pest		
Yes	No	Unsure
73%	9%	18%

Have the IPM practices that you have implemented had an overall economic impact in your vineyard operation?

Yes	No	Unsure
70%	0%	30%

If Yes, has the economic impact produced a:

Net economic benefit (i.e., benefit from better yield (quality and/or quantity) and/or reduce risks, etc.)	Net economic loss (i.e., cost outweighed any benefits)
100%	0%

BENEFICIARIES

The beneficiaries of this project include Vermont's apple and winegrape growers; the majority of apple and grape survey respondents said IPM had a positive economic impact in their farm operation. The State of Vermont is also a beneficiary since the apple and winegrape industries generate jobs and support communities and businesses across the state.

LESSONS LEARNED

See goals and outcomes.

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PROJECT 2: Apple Research Orchard – previously accepted**PROJECT SUMMARY**

Apples are an important component of New England's diversified agriculture. In Vermont, there are currently approximately 2,700 acres (1,092 ha) of apple orchards which generate \$8.9 million in annual cash receipts and \$12.8 million in value-added products. The Vermont Tree Fruit Grower's Association (VTFGA) annually contributes to support programs through the University of Vermont and Extension System as well as state marketing programs and industry lobbying efforts at a federal level. In recent years the industry has seen a loss of support services due to restrictions in funding at the University and government levels. In order to maintain the vital support services provided by the UVM Apple Team and the associated research programs VTFGA requested funding from the Vermont Agency of Agriculture Specialty Crop Funds to support the project outlined below.

VTFGA recognizes the importance of the research orchard plots located at the UVM Horticulture Research Center (HRC) as a place to conduct applied research programs and to facilitate information gathering and dissemination for Extension programs. Since its purchase in 1952, UVM HRC has housed mixed plantings of apples which have adapted with changes in the industry. Early plantings consisted of large trees planted at low densities to a limited number of varieties important to the industry of the time. As planting systems and varieties changed, planting installations included smaller trees planted more closely together and an increased focus on varietal diversification as has been seen on commercial farms. Planting installations typically have been funded by specific project-oriented grants, which has limited their initial use because the plantings do not tend to mature for five or more years. After a project has completed, these blocks become available for shorter-term projects that focus on novel and innovative production systems and methods. In recent years these generic orchard plantings have begun to reach the end of their useful life. Some plantings are seeing attrition of trees due to age or research-related protocols, while none of them reflect the most recent development of high density planting systems. Since the mid 1990's horticulturalists have been promoting the planting of apple trees in a trellised, high density system of 800-1200 trees per acre, as opposed to the mid-density 250-400 tree orchards promoted beforehand, which represent most of the HRC plantings. Long-term horticultural and economic research at Cornell and other Universities (Robinson 2004) has shown the increased productivity and economic return of these systems, and they are being implemented to a limited degree by growers in Vermont. One primary benefit of these systems is their precociousness in that they fruit within three years compared to five to seven in older planting systems. It is critical that future small-plot research occur in these planting systems to best replicate its extension to field

practice. VTFGA is also interested in investing in this type of planting system located at HRC to provide access to our growers for demonstration purposes.

VTFGA supports a phased replanting of the UVM research/demonstration orchards. We suggest that the orchards be designed for best experimental use in the future, and include McIntosh and Honeycrisp in the varietal mix. UVM proposed to start the project in fall 2009 with orchard removal and stumping, if needed, intensive cover cropping, liming, and other field prep in 2010, and field planting in spring 2011. VTFGA, through the specialty crops grant program, donated funding for supplies and materials for the planting. Work at Cornell University has established a cost of \$18,000 (Robinson, DeMarree et al. 2007) per acre for establishment and early maintenance of these modern plantings.

It is essential that research and outreach programs conducted by UVM Apple Program and supported by VTFGA reflect modern technology and planting systems used in our industry. Investment in these systems will provide the Vermont apple industry with real-world demonstration and applied knowledge that will facilitate more efficient orchard management.

PROJECT APPROACH

Modern apple orchard economics favor establishment of plantings at higher tree densities than the Vermont average. While medium (5-10 year) economics favor this system, high establishment costs (c. \$18,000 per acre) increase risk to farmers. Applied research projects should reflect cultivation of these types of orchard systems. In spring 2011, a demonstration high density tall spindle apple orchard was planted at the UVM Horticultural Research Center. Advantages of high density plantings include reduced time to production, as trees yield a marketable quantity of fruit in as little as two years with full production by year five; increased cumulative yield over the life of the orchard; improved fruit quality; reduced labor inputs; and more efficient pesticide applications. The downside to adoption of this system is the high initial cost of orchard installation, as much as \$18,000 in the first year, and the 'learning curve' for growers who adopt this new system. While Vermont growers have been planting more intensive systems such as vertical axe in recent years, adoption of tall spindle has not occurred quickly, as growers are reluctant to invest the significant up-front costs associated with these plantings before they have been proven successful in this region. This orchard was planted with LindaMac McIntosh and Royal Empire trees on Bud. 9 rootstock and Honeycrisp on M. 9 rootstock. Tree spacing is three feet in-row with twelve feet between rows for a tree density of 1210 trees per acre. Trees are trained to a four-wire, eight-foot high trellis.

A subsection of the University of Vermont Apple Team Research and Outreach website was created to provide general information on the tall spindle planting system and specific details on this research orchard:

<http://orchard.uvm.edu/uvmapple/hort/HighDensityApple.htm>

VTFGA provided UVM Apple Team with funds donated from grant proceeds to support the establishment of this model orchard.

In 2012, two outcomes are expected. First, initial yield data will be collected and presented on the abovementioned website. Initial yield is expected to be relatively low, under 100 bushels per acre, but this is in only the second year of the orchard, where older, lower density orchards may not see any fruit for three to five years and may not reach full production until at least year seven. Yields for the three cultivars in the planting will be measured and posted annually to this site. Second, an independent research project which seeks to identify reduced fungicide programs for Honeycrisp, an especially valuable cultivar that exhibits some resistance to apple scab, and thus may produce marketable fruit with less pesticide use, will be conducted. This is expected to be the first of many research programs conducted by the UVM Apple Team in this modern orchard system.

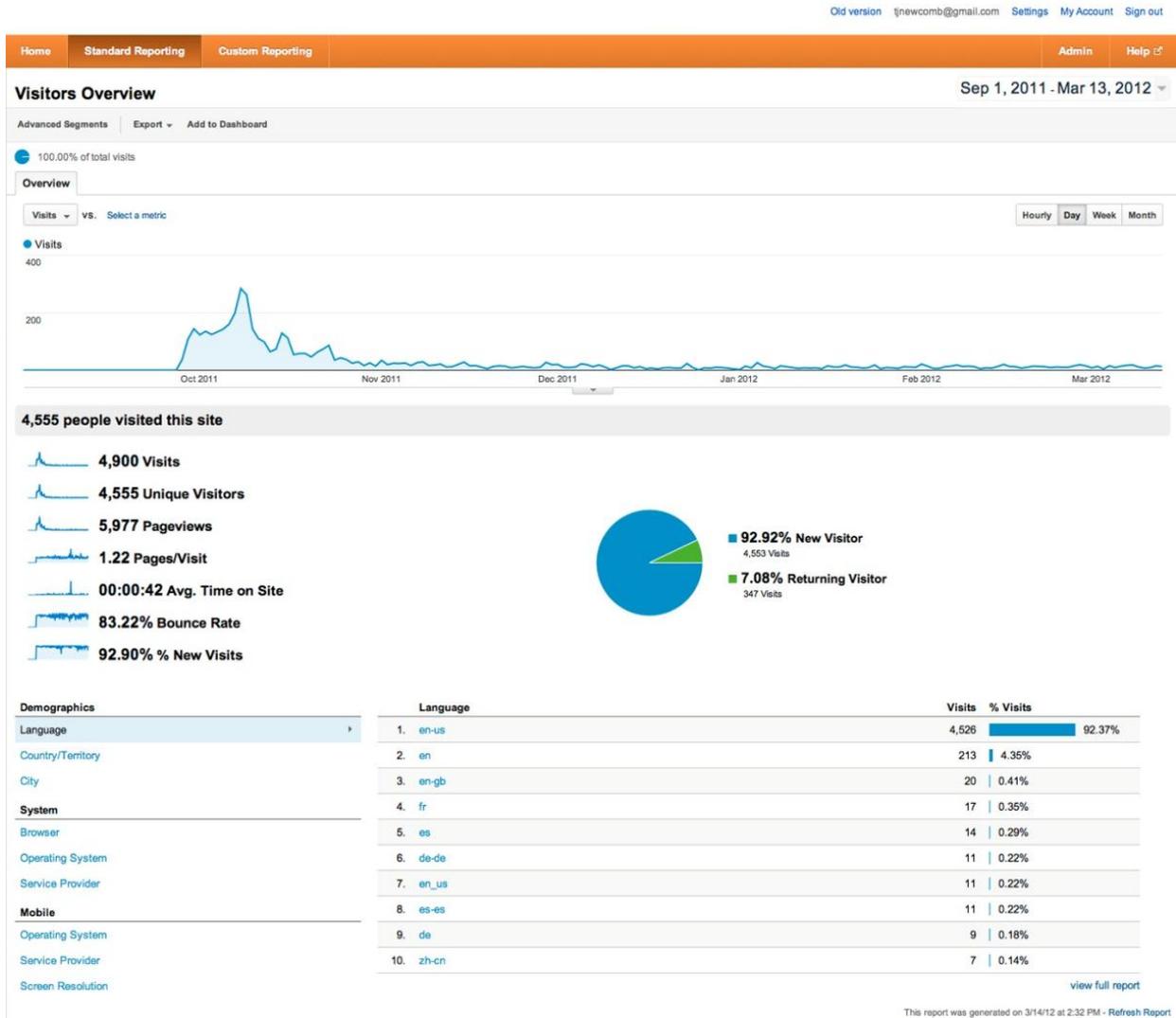
GOALS AND OUTCOMES ACHIEVED

Target goals are long-term in nature:

1. Annual evaluation of the effectiveness of new pesticides (organic and conventional) and growth regulators, reported to growers, and
2. Annual yield data on varieties included in research orchard.

The new orchard was installed in 2011, with initial cropping planned for 2012. This is a significantly shorter interval for seeing fruit production than in older orchard systems, and is key to improving profitability of the system. Yield data and other insights on growing fruit in this manner will be communicated to the Vermont apple industry through UVM Apple Team outreach activities including meetings, workshops, newsletters, and the UVM Orchard website (<http://orchard.uvm.edu>). On August 19, 2011, an Open House Tour of fruit plantings at the HRC was held, and 110 fruit growers and industry professionals attended and viewed the planting.

The website www.vermontapples.org was launched in summer 2011. The Google Analytics report is below. There have been over 4,500 visitors to the site since its launch. We expect website hits to vary seasonally, with more visits during and just prior to harvest season.



BENEFICIARIES

The primary beneficiaries of this project are Vermont apple growers, who may see improved profitability from adoption of this growing system. Average apple yield from 2005-2009 in Vermont orchards was 332 bushels per acre, with a mean adjusted utilized return price per bushel of \$14.12 (NASS 2011). Similar orchards planted in New York, including in the Champlain Valley region, have yielded 1000 bushels of fruit per acre consistently since maturity (Robinson 2006). Increases in production by adoption of new planting systems could increase orchard revenue by \$9400 per acre annually. With 2700 acres of commercial apple production in Vermont (NASS 2011), the potential annual benefit to Vermont growers and the agricultural community could total \$25 million.

LESSONS LEARNED

Establishment of these modern orchard systems is not without risk. The high cost of orchard installation is a potential barrier to adoption. Time and labor requirements in the first season are

high, but reduced labor is expected from the second year on. Compete notes on orchard establishment will be posted on the UVM Orchard website at <http://orchard.uvm.edu/uvmapple/hort/HighDensityApple.html>

CONTACT PERSON

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PROJECT 3: Establishment of Apple Weather Stations – Previously Accepted

PROJECT SUMMARY

Apples are an important component of New England's diversified agriculture. In Vermont, there are currently approximately 2,700 acres (1,092 ha) of apple orchards which generate \$8.9 million in annual cash receipts and \$12.8 million in value-added products. The Vermont Tree Fruit Growers' Association (VTFGA) annually contributes to support programs through the University of Vermont and Extension System as well as state marketing programs and industry lobbying efforts at a federal level. In recent years the industry has seen a loss of support services due to restrictions in funding at the University and government levels. In order to maintain the vital support services provided by the UVM Apple Team and the associated research programs VTFGA requested funding from the Vermont Agency of Agriculture Specialty Crop Funds to support the project outlined below.

Apples and other tree fruits are by their nature a perennial crop which exists in a planting system that encompasses a resident population of pest pressures. The management of these pest complexes is a critical component of the farming system and reflects a need for biologically-based research and outreach program. Vermont apple growers use Integrated Pest Management (IPM) protocols in their orchards. IPM is a knowledge-based, biology-intensive, system of crop management that allows a farmer to reduce prescriptive chemical inputs. This system demands that the grower have an intimate knowledge of the biological system in the orchard including plant development, pest population levels and life cycle status, and predator and other beneficial population dynamics.

A cornerstone of this orchard monitoring program is the availability of site, or at least regionally specific, accurate weather data. Many growers own and maintain personal weather stations for their farms, with varying degrees of system accuracy and implementation. Weather data, however, is only a part of the IPM system; integration of that data into a set of biological models is critical for the information to be of value in helping farmers to better manage their crop. For example, degree day models used for primary insect pests of apples allow a grower to withhold treatment application until pest development is most susceptible, typically saving a grower, the consumer, and the environment from multiple pesticide applications per season. Implementation of individual

stations at farms into these pest development models, and support for farms without on-site stations is a primary component of the UVM Extension support system.

Historically UVM relied on an on-site station at the Horticulture Research Center (HRC) in South Burlington as well as a virtual, extrapolation-based third-party service (Skybit, Inc., Bellefonte PA) which provided data for five locations in fruit-growing regions in the state. Skybit weather products, while tailored as site-specific, are limited in some respects. The data is proprietary and must be purchased by individual growers, is delivered daily but as a static email without an interactive component, and contains limited pest model building. UVM staff collected the information on a weekly basis and summarized it manually, posting the results to the UVM Orchard website (<http://orchard.uvm.edu>). This system limited the time-sensitivity and therefore applicability of this data. UVM spent about \$3000 annually on this service.

Cornell University operates the Network for Environment & Weather Applications (NEWA, <http://www.nysipm.cornell.edu/newa/>) through its IPM office. This program formally integrates individual weather stations located on grower farms and connects their real-time data with crop pest models that output very usable information that facilitate real management practices. Included in this system is the ability to tailor models to individual farms by allowing for input of specific plant growth stage or pest emergence data.

In June 2009 VTFGA purchased a NEWA station (\$2000) for installation at a participating orchard. The real-time data available in the network and its use in specific pest models is of immediate use to growers in implementing their IPM programs. VTFGA proposed purchase of five stations which were made available for use by the UVM Apple Team as needed for their statewide research and outreach programs. These stations have provided an improved method for delivering the IPM programs that UVM offers. With SCBGP#17 funds, five more stations were purchased and installed in 2010. The system was maintained and data delivered in 2011, with continued service expected.

PROJECT APPROACH

Established 5 new weather stations for installation at orchards selected from across the state to reflect regional growing conditions. The stations will allow Vermont apple growers to receive more timely and accurate information on pest control and other orchard maintenance functions. Stations were established in varied regions and elevations to best reflect diversity of orchards in the state. Locations include: Calais, Dorset, Putney, Shoreham, South Burlington, South Hero. A privately-owned station in Saxton's River is also connected to the network, as are all state airport weather stations. Stations were installed by UVM Apple Team staff with continuing support provided. Other funds are used to pay annual subscription costs which will total \$5750 in 2012.

VTFGA/SCBGP funding secured stations for deployment at participating grower-cooperators. Other project partners included Cornell University Network for Environmental and Weather Applications, who develop and maintain end-user models and the functional website interface, and Northeast Regional Climate Center, which houses the data.

GOALS AND OUTCOMES ACHIEVED

Growers were surveyed at the 2012 Vermont Tree Fruit Growers Association annual meeting, attended by over 50 commercial apple growers, for information on project use and impact on their management decisions. Of the survey respondents, 100% answered that access to online weather data would be useful to their operations. Sixty percent of respondents had accessed the NEWA system, with some respondents commenting that stations were not located close enough to their farm, suggesting that increased coverage of the network could be effective in increasing usage. Of the growers who accessed the system and used the weather data and pest models in their operations, 67% answered that the system helped to reduce pesticide applications on their farms and that the efficacy of pesticide applications was improved. Thirty three percent of respondents answered that NEWA benefited them through cost savings from reduced or more effective pesticide applications, and 17% indicated that the system improved labor efficiency on their farm.

Due to funding timing, a backup at the station manufacturer, and the extremely early commencement of the 2010 growing season, the stations were not able to be deployed until at or just past bloom in the initial season. This contributed to limited functionality of some models which required earlier collection of weather data for degree day purposes. In 2011, stations and the NEWA network were fully operational for use during the growing season. Station operation has required maintenance by UVM Apple Team staff to address ongoing setup and communication issues. Internet connections at grower sites have been an issue as stations fail to automatically upload data. UVM staff continually monitor system and developments in technology; stations will receive continued support in 2012 and beyond.

On July 31, 2010, New York State pulled IPM funding that supported the NEWA program, among others. In order to maintain system solvency Cornell cooperators have revised fees to access the network, to \$5750 for 2012. VTFGA and/or UVM Apple Team will pay these fees in 2012 from non-SCBGP#17 funds.

BENEFICIARIES

The primary beneficiaries of this project are Vermont apple growers, who may see improved profitability and reduced environmental impact from adoption of this monitoring system. Growers of other specialty crops including grapes and vegetables may also use the system which is publicly available, and includes pest models for those crops. Other beneficiaries include the general public, who may see reduced pesticide applications from better implemented IPM systems in orchards and on farms.

LESSONS LEARNED

Station maintenance is critical to maintaining the usability of the network. Individual farmer cooperators, VTFGA, and UVM personnel must monitor and troubleshoot the network to ensure that stations are reporting as they should. NEWA cooperators have an automatic, daily email sent to UVM personnel that updates system problems and aids in diagnosing problems. The stations were

extremely useful in 2011 and the growers look forward to their continued use in the NEWA network.

CONTACT PERSON

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PROJECT 4: Vermont Queen Bee-Rearing Program – Previously Accepted

PROJECT SUMMARY

The original goal of this program was to introduce ten Vermont beekeepers to the process of queen rearing, with the intention of increasing the number of locally produced queen bees available to Vermont beekeepers. Because southern raised stocks don't winter well here in the north, it was hoped that making northern raised queens selected for their ability to carry their colonies through our Vermont winter would improve the beekeepers' chances of success. In recent years, wintering bees in the north, using the available southern stocks, has become a real challenge. As northern queen breeder, I have seen the improvement in the wintering and production in my many apiaries. With all the new beekeepers trying to keep their bees alive, and failing, it is only a matter of time before they drop out of the industry. Providing them with suitable honeybee stocks is now or never.

PROJECT APPROACH

The original goal was to run a two year program. The first year, group members would learn basic queen rearing principles. The year went well with normal problems. We had a winter meeting to discuss these issues and find solutions. The second year, the group learned to use specialized mating nucleus hives for mating the queens. They were also instructed on use of specialized breeder boxes for harvesting twelve hour old worker bee larvae to use in the grafting process. Two instrumentally inseminated breeder queens, raised from selected hygienic stocks, were provided for stock improvement. Group members had difficulties getting their mating nucleus colonies fully stocked due to the poor weather and flow conditions during the 2011 season. This is expected to improve in 2012, due to stock improvement interventions.

Even though these folks are only novice queen breeders, they have already contributed to the beekeeping community in Vermont. In both 2010 and 2011, they provided the mated queens for the Vermont Beekeepers workshop on setting up and wintering nucleus colonies, to be used in lieu of packaged bees from Georgia and Texas. In the past two years, the VBA queen rearing program has produced the queens needed by seventy five beekeepers to get a start in the raising of their own replacement stocks. Our queen rearing program is only one half of the whole program. Although we didn't ask for any grant money, the nucleus colony program is really the more important of the two. This teaches Vermont beekeepers how to raise their own bees, and give them the expertise to get

off the southern bee treadmill. The queen rearing program is the second step, and once we get the production of local queens high enough, Vermont beekeepers will be back to a sustainable position.

GOALS AND OUTCOMES ACHEIVED

In 2010, the first year of the project, the members had to learn a queen rearing method. In May, each member set up their own colonies with bees and equipment provided by the grant. In June, following the plans laid during the classes, each member created cell building colonies, learned how to graft young honeybee larvae, raise queen cells, install those cells in nuclei, and harvest mated honeybee queens. The members are also now teaching the queen rearing and nucleus colony workshops, a community service using what they've learned in the program.

In 2011, the grant participants continued to make progress in their queen rearing. The group met on two occasions, to discuss problems encountered in 2010, and possible solutions, and also watched videos on various queen rearing methods from around the world. The group is growing in its experience and is increasing production slowly.

In 2010, the group of nine produced 413 queen cells. From these cells, 254 queens were mated. Of those queens, 157 were used in the apiaries of the producer, and 97 were sold to other beekeepers. The usual mistakes were made by every participant, but the program is designed to teach by lectures and experience.

For 2011, only seven producers have reported. The two not reporting didn't do well last summer and I question their further participation. This was truly a difficult year for beekeeping, and we'll see what happens this year coming.

Seven of the producers raised 558 queen cells. From these cells, 348 queens were mated. Of those queens, 207 were used in the apiaries of the producer, and 141 were sold to other beekeepers. Both the total number of queens produced, and the number of queens sold to other beekeepers increased by more than thirty percent. From the year-end report received from each participant, there can be no doubt that the weather played a significant part in not reaching that goal. 2011 was among the worst production year in 40 years. So we go on remembering this is agriculture and next year is another year.

The project is long-term; it takes time and experience and successes and failures. The original projection was the production of 5000 queen bees in Vermont by 2015. At this time the level is approximately 2350, counting the two existing queen operations and the VBA queen producers. Once each member can produce 300 queens in the season, the goals will have been achieved.

BENEFICIAIRES

The membership of the VBA has greatly benefitted. They now have lectures and workshops being taught by the VBA Queen Rearing group. They have been given a source for local queens that will increase over time, which will increase the success of our local Vermont beekeepers.

In the two years of the grant, a total of 602 mated queens were harvested. Of these, 238 were used in colonies owned by Vermont beekeepers

LESSONS LEARNED

Future workshops should provide more hands on time, perhaps at a successful own queen rearing operation. The students made some basic mistakes that everyone makes, but sometimes a failure is the best teacher. When mistakes were made, they were discussed at the following meeting, and corrected during the second year of the project.

It is projected that in a few years the members of the group will produce as many as 1000 queens among themselves, worth some \$25,000.

CONTACT

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PROJECT 5: Vermont Maple Industry Marketing and Education

PROJECT SUMMARY

Two sets of activities were funded under this grant: 1) publicity for the 2010 Vermont Maple Festival; and 2) 2011 intensive production workshops for sugarmakers.

Comments from evaluation sheets filled out by attendees at workshops were extremely positive. The majority felt they received the information they needed to add or improve vacuum systems at their small operations.

PROJECT APPROACH

A multimedia approach was used to market and promote the 2010 Vermont Maple Festival, including print, radio, television ads, website and press releases. The major goals were to promote and educate about the qualities, production and uses of Pure Vermont Maple Syrup and other Pure Vermont Maple Products, increase attendance at the Festival where promotion and education take place, and increase overall sales of Pure Vermont Maple Syrup.

A workshop on Vacuum Systems for the Small Maple Producer was held in two locations in Vermont in September of 2011. One in Shaftsbury, VT in Bennington County and another in Hardwick, VT in Caledonia County. Comments from the evaluation sheets which were filled out by

attendees were extremely positive. The majority felt they received the information they needed to add or improve vacuum systems at their small operations.

At a VMSMA directors meeting in 2012 it was voted to sponsor workshops that were being planned for September 2012 by the Addison County Maple Sugarmakers Association and also by the Franklin County Maple Sugarmakers Association. The Addison County group was planning for a workshop on the "Game of Logging." This workshop was inspired by the untimely death of an Addison county sugarmaker who was killed while working in his sugarbush. The Game of Logging (GOL) is a training program developed by a Swedish logger in the 1960s to increase attention to safety and reduce injuries. The result has been lower injuries to professional loggers, maple producers who thin their sugar bushes to improve their sap production and landowners who cut firewood or manage their properties. The "game" in the Game of Logging refers to the necessity of having a plan or strategy for felling trees and working safely in the woods. The long term sustainability of a maple operation depends upon proper management of the sugarbush in order to maintain the health and vigor of the trees, to improve the ability to maximize high quality sap and to improve the profitability of the operation. Many maple producers do hire consultants to develop a management plan however most sugarmakers do the actual work in their sugarbush. The skills they learn from The Game of Logging helps them to carry out these improvements to increase production of sap to make maple syrup in a safe and effective manner.

The Franklin county group was in the planning stages of hosting a maple school in the fall to augment the VMSMA January maple schools.

GOALS AND OUTCOMES ACHIEVED

Because the Festival has no "gate" or entrance fee, increase in attendance, which was the major goal of the project was determined in a variety of ways: 1) we counted a greater number of license plates from southern New England in the lot than in previous years; 2) advertising and web presence attracted a group of 5 planes from the northeast pilots group to fly in and spend a day at the Festival; and 3) sales reports available from vendors overall showed increases from the previous years. We have concluded that the goal of increasing southern New England attendance at the Festival was achieved due to the above sales increases and monitoring of license plates in the parking lots, and by comments of leaders of the bus tours to the sugarhouses who conversed with visitors on the buses.

The goal of the workshops on Vacuum Systems for the Small Maple Producer was to offer options and solutions for the small producer to increase production of maple syrup. Comments in a survey directly after the workshop was held were extremely positive and people stated that they felt they received the information they needed. In a survey to attendees in October 2012, a year after the workshop was offered, the question "Did learning about vacuum systems at this workshop increase your syrup yields from the previous year?" was asked. Comments received were as follows:

- "I am interested in applying what I learned about "high vacuum in gravity tubing" from the research that Tim Wilmot has been doing from what I learned in the workshop but haven't

done anything about it yet. Waiting for more information and greater availability of supplies for 3/16" tubing."

- "It's hard to say if it increased my yield as it was my first year in production. I did however learn a lot a new things and tips about vacuum pumps and the proper way to set-up tubing in the woods."
- "It sure did."

The goal of the "Game of Logging" was to offer education, strategies, and safety information for sugarmakers so they can be safe in the woods. The participants were fully engaged in the day-long training and successfully completed Level 1. Certificates of completion were mailed to the participants after the training. There was one "professional" in the group that has been logging for a long time and has even worked in lumberjack competitions.

The goal of the Franklin County Maple Conference was to offer education to sugarmakers about the different aspects of maple production and to offer a central location for equipment dealers and manufacturers to show the latest maple equipment. The speakers were very happy with the small class size that allowed for Q&A and sometimes in-depth discussion about a topic. There were many wonderful comments from the attendee and vendors about the school and the committee has already started planning for a second annual conference to be held in September 2013.

BENEFICIARIES

The beneficiaries of the Vacuum workshops were the 65 people who attended the workshop in either Shaftsbury or Hyde Park, Vermont. If the workshop helped any of the attendees increase their production they certainly benefited from taking a day from their busy lives to attend.

The beneficiaries of the "Game of Logging" were certainly the 10 sugarmakers who took the training. One can hope that the lessons learned at this workshop will be passed on to others that work in the woods with those who took a day from their busy lives to attend. Clearly, if the training can prevent tragic accidents from happening we all benefit.

The beneficiaries of the Franklin County Maple Conference were clearly the 132 attendees. One can hope that what the attendees learned during this day-long session will help them increase production and efficiency in their maple operations. And also what they learned will be passed on to others that they work with in their maple operation.

LESSONS LEARNED

Lessons learned at the Vermont Maple Festival were that 1) radio trivia contests offering Vermont maple and a trip to Vermont create excitement, 2) a coupon ad did not create a significant number of respondents, 3) banner ads are a bonus, and 4) an attractive website is important to success.

The results from offering the three workshops and school to sugarmakers were very positive. Most comments were very positive about the presentation of the topics and what they learned. There did not seem to be any negative results.

The one thing that we learned is that there needs to be more continuing education throughout the year in many different areas of the State. There are areas of the State that are being underserved, mostly because of geography and the time required to travel to locations.

CONTACT

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PROJECT 6: Vermont Grape & Wine Industry Development - Previously accepted

PROJECT SUMMARY

The purpose of this grant was to provide funding for 2010 – 2011 to promote and develop the grape and wine industry in Vermont.

With the commercial introduction of cold-hardy wine grapes developed by the University of Minnesota, Vermont's wine industry, although still small, has grown rapidly. The wine industry has been identified as a potentially important new sector of agricultural tourism. As a relatively new wine producing region, Vermont vintners and fruit producers must quickly develop their marketing skills to attract new customers. The Council, in conjunction with the Agency and UVM, provides technical assistance to the industry through conferences, workshops, and other presentations on topics such as marketing, product development, quality control and product safety. In addition, the Council supports the marketing of Vermont made wines through its website, festival participation and other programs that benefit the industry as a whole.

PROJECT APPROACH

The following activities were performed in 2010 and 2011 with support of funds from this grant:

Winemaker and Grower Education

- The Council put on an Annual Conference in June of 2010 with educational seminars for grape growers and winemakers. Experts in vineyard techniques and winemaking practices were engaged to provide workshops and these were very well received.

Consumer Events

- A new Open Winery Weekend was held across the state with wineries and grape growers producing special events on site. Advertising and promotion for this new event was supported with grant funds.
- The Open Winery Weekend was held again in August of 2011. Awareness and attendance increased substantially over 2010, thank to promotion and advertising of the event supported by the grant. We look forward to continuing this annual event that increases awareness of Vermont wines among Vermonters and visitors to the state.

- The Council sponsored and participated in several high profile festival events that celebrated Vermont food and wine. These included the Killington Wine Festival in July 2010, the Vermont Cheesemakers Festival in July, 2010 and 2011, and the Lake Champlain Maritime Festival in August of 2011. The Council was a key participant in organizing the Vermont Life Wine & Harvest Festival in September 2010. Unfortunately this event was cancelled in 2011 due to Hurricane Irene.

Ongoing awareness and promotion of Vermont Wines and Wineries

- Updates were made to the Council website to add new wineries who have obtained their licenses and are open for business
- A passport program was designed and introduced in 2011. Consumers were given a map and listing of Vermont wineries and the wineries were provided with stickers to put on the passport when consumers visited them and presented it. Consumers who collected stickers from at least 10 wineries could then submit it at the end of 2011 to be part of a drawing for prizes provided by participating Council members.
- The council conducted an RFP process and hired Wendy Knight of Knight and Day Communications to create a PR strategy, develop a press kit, and to promote the Open House Weekend and Vermont Grapes and Wines more generally among the press and social media.

GOALS AND OUTCOMES ACHIEVED

Goal: Increase vineyards and wineries participating in the Council and receiving program benefits

- The number of licensed wineries in Vermont has grown from 15 in 2008 to 30 in 2010, and continues to increase
- Membership in the Vermont Grape & Wine Council has grown from 40 people to 60 people
- Over 90% of members attended the annual educational conference

Goal: Increase awareness of Vermont wines among consumers

- Website traffic has increased 50% since 2009. See <http://www.vermontgrapeandwinecouncil.com>
- Marketing Events: The Council participated in several new marketing events in 2010 and 2011:
 - Vermont Life Wine & Harvest Festival (2010, cancelled in 2011 due to Irene)
 - Vermont Cheesemakers' Festival (2010, 2011)
 - Killington Wine Festival (2010)
 - Lake Champlain Maritime Festival (2011)
- Attendance at the festivals in which the Council participated with its own booth to promote the industry as a whole was over 2,000 people in 2010 (VT Cheese, Killington, VT Life Wine & Harvest) and 2000+ in 2011 (VT Cheese, Maritime). 1,000 rack cards were distributed at these events. In addition members of the press were in attendance and several articles were written

in major Vermont publications about Vermont wineries at the festivals. A summary of the awareness achieved via the PR work is attached.

- An attempt to survey consumers was made at the Vermont Cheesemakers' Festival in 2011 and the Vermont Life Wine & Harvest Festival in 2010. Unfortunately extremely few of the survey forms handed to festival goers were actually returned, so results were not a valid representation.
- Attendance at wineries and vineyards across the state during Open Winery Weekend Grew substantially from 2010 to 2011, with several wineries reporting more than double the attendance of 2010.
- Almost 200 people completed and submitted their wine passport for the reward drawings. A completed passport required consumers to visit at least 10 Vermont wineries for tours and tastings. It can be assumed that a larger number of people visited several wineries with the passport, but did not complete it in time for the drawing.

BENEFICIARIES

There are 29 vineyards, wineries, cideries and mead makers who are members of the Vermont Grape and Wine Council and benefited from this project.

1. Existing Vermont vineyards and those contemplating starting vineyards in Vermont. These members benefit from the educational conference which covers topics in grape growing from variety selection to pest and disease management to grape yield and quality management. These members also benefit indirectly from the marketing programs that support the growth and commercial success of wineries who are the buyers for their grapes.
2. Existing Vermont wineries and new start-up wineries. These members benefit from the annual education conference which covers topics in winemaking and marketing including sanitation practices, sulfite use, acidity measurement and management, tasting room best practices, and distribution issues. These members also benefit directly from the Council marketing programs that are funded by this grant.

The officers and members of the Vermont Grape & Wine Council are extremely grateful for the support of this grant, which has enabled the Council to execute key programs for this small but growing agriculture-based industry. Unlike other industries where there are at least one or two large companies that can help to support association efforts, all of our members are small businesses, and many are in start-up mode.

LESSONS LEARNED

The passport program was very successful in its infant first year. The program materials need some improvements, but this is definitely a program that should be supported and grown. Many members reported people coming to their wineries who would not have known about them without the passport.

The annual conference is highly valued by members. The quality of the experts has been high and the learnings provided have been directly implemented by attendees.

The website is an important source of traffic to members individual winery websites. We need to do a better job of measuring this and understanding how to improve further.

Not all marketing events are successful for winery participants and the Council should be involved only in those which meet key success criteria. We've been learning what those criteria are, and have a much better sense. The Vermont Cheesemakers Festival and the Vermont Life Wine & Harvest Festival continue to be two major events worth Council support. Examples of support that was not productive included the Lake Champlain Maritime Festival, where the audience, while large, is not there for the purpose of tasting and buying wine, and the set-up of the venue makes it difficult for them to do so. We will be judicious going forward to focus resources on Council support of those events that are most likely to build awareness of VT wines with consumers and support sales of winery participants.

Gauging consumer awareness and perceptions of Vermont wines at events is not effective. Consumers are not in the mood to fill out surveys, and those that attend festivals are likely not representative of consumers at large. While the Council would like to have some measurement mechanism to understand quantitatively how the perception of Vermont wines is improving, we lack the expertise and resources to do that. Instead we are looking to the increase in press activity and the number of passport participants as measures of success going forward.

CONTACTS

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PROJECT 7: Produce Safety Training and GAP Audits

PROJECT SUMMARY

Vermont berry and vegetable growers must develop skills to become more competitive in the world market. Those skills include becoming more cognizant of food safety issues and becoming more involved with third-party audit processes, in particular GAP. In an effort to increase awareness and participation in the third-party audit process, the Vermont Agency of Agriculture, Food and Markets (VAAFAM) offered reimbursements of up to \$500 to cover USDA GAP-audit costs, educational opportunities to farmers, and support for our state GAP auditor to remain current in his knowledge.

Due to lower-than-anticipated numbers of GAP audits, funding was also used to subgrant to UVM to conduct a study on best practices for wash water ([See Project 16, below](#)).

PROJECT APPROACH

Fruit and vegetable producers in Vermont continue to seek GAPs technical assistance and audit support to meet food safety requirements of particular buyers and markets. In response to this growing market demand, the Vermont Agency of Agriculture, Food, and Markets (VAAFAM) remains committed to offering GAPs audit reimbursements of up to \$500 to cover USDA GAP-audit costs, educational opportunities for farmers, and support for our state GAP auditors to attend professional development trainings.

Five producers went through the audit process and received reimbursements in 2009, and 15 producers received reimbursements in 2010 (the original five, plus an additional 10). In 2011, 20 producers went through the USDA GAP audit through VAAFAM. One of the original producers moved out of state, and four were audited by NOFA-VT through the Organic/GAPs pilot program. Approximately 30 producers were anticipated to receive audits from VAAFAM during the 2012 season. In 2012, 20 producers went through the audit process with VAAFAM. Two orchardists canceled due to weather damage to their crops and at least three others, that UVM Extension education staff had indicated would seek an audit for the first time this year, did not contact VAAFAM. These producers likely felt underprepared this growing season and will try next year. Consequently, at least 25 producers requiring USDA GAP audits are anticipated to participate during the 2013 growing season.

Additionally, we continue to partner with UVM-Extension to deliver practical produce safety training at events throughout the state to producers whose size and market outlets do not require a full-blown USDA GAP audit. UVM-Extension and NOFA-VT delivered produce safety training at a workshop attended by over 50 producers at the Direct Marketing Conference in January 2012. Four on-farm workshops are scheduled for spring 2013 and supported by a USDA Farm to School grant secured by VAAFAM.

GOALS AND OUTCOMES

The goals of the GAP audits were to:

1. Provide USDA GAP audit reimbursements for Vermont fruit and vegetable producers whose market, size or industry interests required a third-party audit inspection.
2. Hire and train additional GAP auditors at VAAFAM capable of conducting USDA GAP audits for the increasing number of interested produce growers.

Goal 1 was successfully achieved. Over 31 Vermont fruit and vegetable producers received GAP audit reimbursement payments. Most operation's initial and unannounced audit costs totaled just above \$500, therefore participating farms appreciated the reimbursement during their first two years of the USDA GAP auditing process. Offering audit reimbursement support was an incentive to certain fruit and vegetable operations to increase production and access new markets without the added hardship of expensive GAP audit costs.

Goal 2 was successfully achieved. VAAFAM added two new GAP auditors; one became certified during the 2012 season to conduct USDA GAP audits while the second is currently participating in trainings. This allowed for 59 USDA GAP audits to be conducted on Vermont farms and more farms to become audited in the future. Additional distributors and retailers are pushing for GAP certification and the industry's trend may require USDA GAP auditors to become trained in

harmonized GAP audits, requiring additional travel and trainings. This will also translate into additional literacy training for growers who will need to meet additional reporting and record keeping requirements.

BENEFICIARIES

Access to GAP audit reimbursements benefited 31 fruit and vegetable producers. Access to additional GAP auditor capacity benefited over 59 operations. Produce trainings were attended by over 50 farmers and interested stakeholders and the capacity to offer ongoing trainings and practice produce safety assistance has been extended to hundreds of additional growers and operators.

LESSONS LEARNED

The need for GAP audits and practical food safety trainings will continue to grow as the industry requirements for increased reporting, traceability, and food safety practices expand. More producers are looking to wholesale markets to expand their operations and add new customers. Additional farms feel driven to participate in GAP audits for liability purposes. Regardless, the need to support GAP auditors and alleviate the initial costs associated with the food safety third-party audits will continue to be a requirement of the produce industry.

Additional distributors and retailers are pushing for GAP certification and the industry's trend may require USDA GAP auditors to become trained in harmonized GAP audits, requiring additional travel and trainings. This will also translate into additional literacy training for growers who will need to meet additional reporting and record keeping requirements.

CONTACT

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PROJECT 8: Hop Production Systems Research – Previously Accepted

PROJECT SUMMARY

New England is home to many high-quality microbreweries. With the popularity of the local food movement reaching into the beverage market, many local breweries have expressed interest in encompassing local ingredients in their beers. As hops haven't been commercially grown in this area for over a hundred years, the purpose of this grant was to provide high-quality local research and technical assistance to farmers looking to diversify with hops. It is projected that in the upcoming year, the number of microbreweries across the nation will increase by 25%. The craft beer industry is highly competitive and brewers are always looking for something that will give them an edge over the competition. Brewing beers with *terroir* is one of these ways. In these tough economic times, diversifying in agriculture is a good way to ensure economic stability. Hops sold

locally have a high economic return, grossing between \$10,000 and \$20,000 per acre, and provide an excellent new market. However, the vast majority of hops research and outreach has been developed for the arid Pacific Northwest, where 99% of commercial hops are produced. The applicability of this research is limited in the humid Northeastern climate, fostering the need for locally relevant, high-quality research based information and a source through which that information can be distributed as it is developed.

PROJECT APPROACH

The objective of this program is to develop local and relevant research and outreach applicable to hops production in the Northeast. Through this project research on hops production has been initiated and numerous educational materials and programs have been delivered to stakeholders.

Hop Variety Trial

Over the last two years, UVM Extension has strived to be a source for relevant information to interested hop growers in the Northeast. To this affect, an experimental hopyard was established in Alburgh, VT during the spring of 2010. The process of constructing the hopyard, materials, and costs were documented and posted on the project website and YouTube for stakeholders to view (see Outreach section below). Within the hopyard nineteen hop varieties were planted in a replicated complete block design with 3 replicates. The hopyard was planted in August 2010, 3 months behind schedule, as that was when the vegetative hop cuttings arrived from our collaborators in Washington, as part of an USDA OREI grant. One goal of this project is to determine hop varieties that demonstrate disease and pest resistance in combination with high yields, and also present desirable characteristics to brewers under Northeast climate. **The results presented below are from the first year of production.**

RESULTS

Cluster outperformed all other varieties, averaging 3.58 lbs/hill at harvest moisture, and 0.74 lbs/hill at 8% moisture, or 2,228 lbs/acre at harvest and 459 lbs/acre at 8% moisture (Table 2). Liberty was the worst performing variety, although statistically not different from Centennial, Crystal, Fuggle, Glacier, Liberty, Mt. Hood, Perle, Saaz, Santiam, Sterling, Tettang, and Vanguard (Table 2).

Table 2. Yields at harvest moisture and at 8% moisture by variety.

*Indicates not enough sample to measure

Variety	Yield at harvest moisture		Yield at 8 % moisture	
	lbs/hill	lbs/ac	lbs/hill	lbs/ac
Cascade	1.71	1060	0.41	254
Centennial	0.44	273	0.11	70.0
Chinook	1.20	747	0.30	189
Cluster	3.58*	2230*	0.74*	459*
Crystal	0.37	232	0.09	53.8
Fuggle	0.13	77.8	0.03	19.3
Galena	1.87	1170	0.49	303
Glacier	0.87	539	0.22	138
Liberty	0.02	12.3	0.00	0.0
Mt. Hood	0.53	329	0.12	76.7
Newport	1.54	959	0.41	257
Nugget	1.40	870	0.35	217
Perle	0.07	43.2	0.02	12.0
Saaz	0.05	28.4	0.01	7.3
Santiam	0.31	193	0.06	40.4
Sterling	0.05	31.9	0.01	7.9
Tettang	0.08	48.9	0.02	12.6
Vanguard	0.37	227	0.09	58.8
Willamette	1.60	993	0.41	256
Mean	0.84	526	0.20	127

Alpha acid percentages for Cluster, Cascade,

Galena, and Vanguard fell within industry averages. Nugget and Willamette exceeded industry alpha acid averages (Figure 1). Beta acid levels for Centennial, Cluster, Crystal, Mt. Hood, Newport, Nugget, and Santiam all fell within the industry averages. Cascade, Chinook, Fuggle, and Willamette all had beta acid levels higher than industry averages (Figure 2).

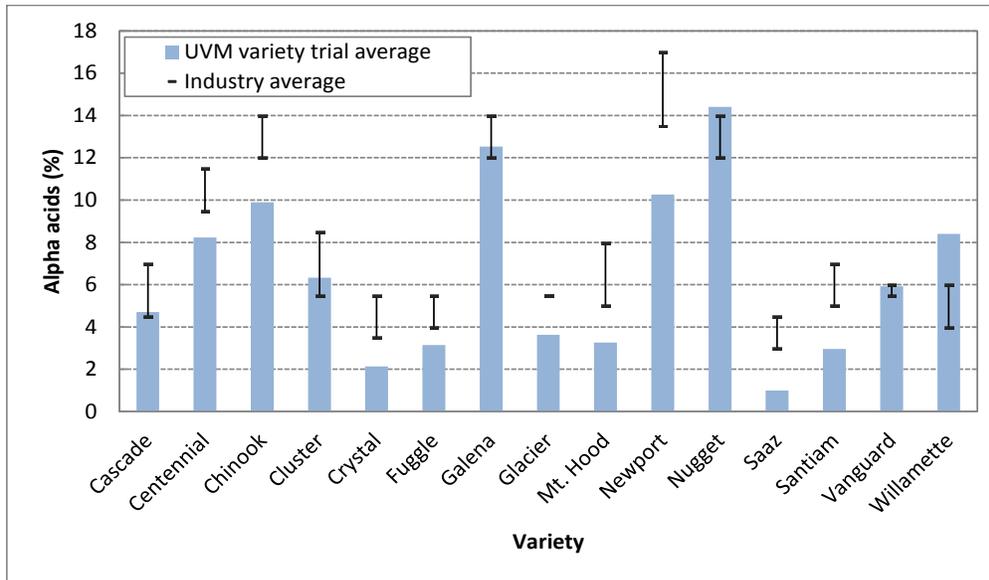


Figure 1. Alpha acid levels from the UVM Extension hopyard compared to industry averages calculated from values presented by Hopunion CBS, LLC and Yakima Chief, Inc.

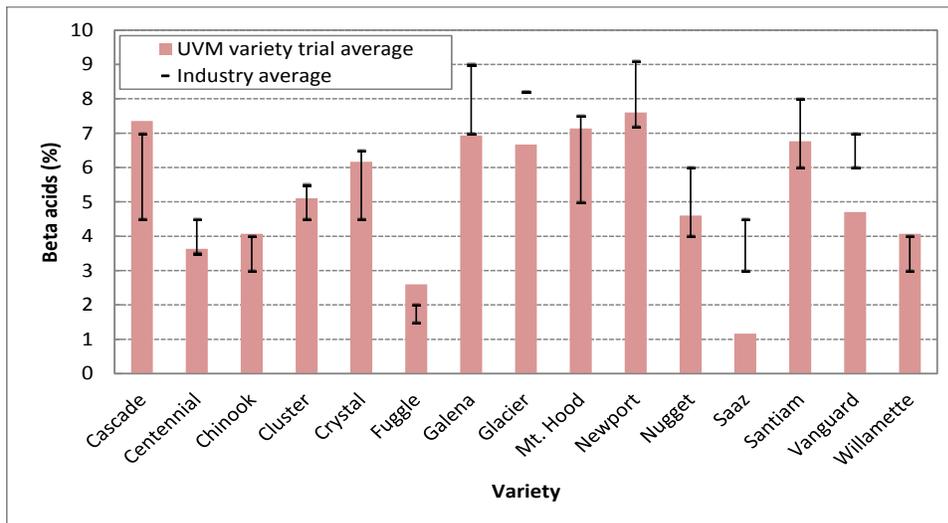


Figure 2. Beta acid levels from the UVM Extension hopyard compared to industry averages calculated from values presented by Hopunion CBS, LLC and Yakima Chief, Inc.

DISCUSSION

The UVM Extension hopyard was planted in August of 2010, putting the yard at stage of maturity between one and two year old plants. According to Jason Perrault, a fourth generation hop grower who presented at the UVM Extension 2010 Winter Hops Conference, first-year yields are generally assumed to be approximately 25% of a mature yard's yields. Some varieties, such as Cluster and Galena, yielded well for first year-plants. Other varieties, namely Santiam, Fuggle, Tettnang, Perle, Sterling, Saaz, and Liberty, did not thrive nor yield well. Hops, like grapes, have *terroir*: their brewing characteristics and oil content are reflective of their microclimate. Hops grown on the East Coast, even though genetically the exact same, will not be like hops in the Pacific Northwest due to different soils and different climates. Hops grown in the Northeast will present unique brewing characteristics. It is important to evaluate hops in different localities to develop geographically specific profiles for varieties that grow well in those regions.

We are encouraged by the first year yields and performance of the hopyard. However, a perennial crop needs time to express its full potential. A hop plant is considered at maximum production in year 4 of its lifespan. Therefore continued research is a necessity to fully document appropriate varieties for this region. If funding is obtained we plan to continue the variety trial research experiment. It should be noted that this is the first hops research trial to be established in the Northeast. It is also the only certified organic hops research trial in the Northeast. Therefore the data and information is being sought from multiple states.

Hop Organic Fungicide Trial

Through our work in hops we have found that there is very little research available that documents the efficacy of organically approved pesticides. The goal of this project was to evaluate the efficacy of several common organic fungicides. Research was conducted at the UVM Horticultural Farm in South Burlington, VT to evaluate the effects of different organic fungicide treatments on hops. Cascade rhizomes were harvested on April 3rd, 2010, and planted in Fafard 2 potting mix on April 7th and 12th, 2010 before successful plants were transplanted into 1 gallon pots. The pots were arranged in a greenhouse in a randomized complete block design with three replications. Each pot received twice daily drip fertigation for 2 minutes at a time, at a rate of 17-4-17, 250 ppm N. Bines were trained to the height of the greenhouse, approximately 13'. Treatments were OMRI listed organic fungicides; Kaligreen (potassium bicarbonate soluble powder), Regalia (extract of *Reynoutria sachalinensis*), Sonata (*Bacillus pumilus* strain QST 2808), and JMS Stylet Oil (white mineral oil), as well as a compost tea and a water spray control. All treatments were applied using a backpack sprayer, and sprayed to the point of runoff. Compost tea was brewed following the guidelines of the Pennsylvania Department of Environmental Protection (<http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/tea/tea1.htm>) and applied at a rate of 91.5 gallons/acre. All fungicides were sprayed according to label specifications. Kaligreen was applied at a rate of 2.32 lbs/acre. Regalia and Sonata were each applied at a rate of 1.86 qts/acre. Stylet Oil was applied at a rate of 3.66 qts/acre. Fungicides were applied on a 10 – 14 day interval, depending on the weather.

The number of burrs per plant was counted, and phytotoxicity and mite damage were evaluated on a visual rating with a 0 – 10 scale, with 0 representing little to no damage, and 10 being complete decimation. All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate treatment means when the F-test was significant ($P < 0.10$).

Table 1. Effects of organic fungicides on hops.

Treatment	Number of burrs	Phytotoxicity	Mite damage
Compost tea	19.0*	3.22*	2.89*
Control	17.0*	2.39*	2.67*
Kaligreen	4.89	3.61	5.28
Regalia	9.78	2.28*	2.28*
Sonata	18.3*	2.94*	3.28
Stylet Oil	14.0*	6.78	6.22
LSD (0.10)	8.41	1.21	1.00
Trial mean	13.8	3.54	3.77

* Treatments that did not perform significantly lower than the top performing treatment in a particular column are indicated with an asterisk.

NS – Treatments were not significantly different from one another.

Compost tea resulted in the greatest number of burrs per plant, most likely due to the extra nutrients provided by the tea, but did not differ significantly from the number of burrs found on the Stylet Oil, Sonata, or water control treatment.

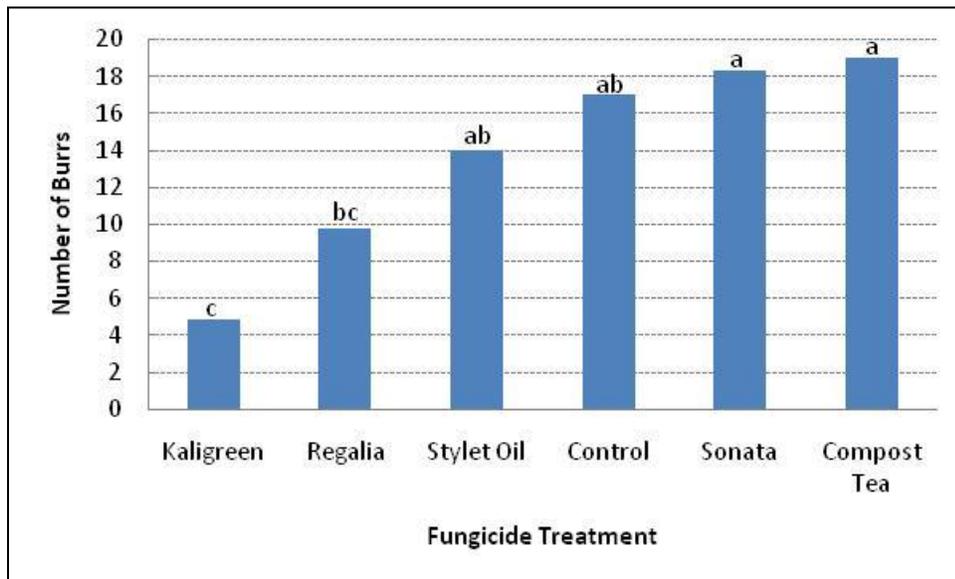


Figure 1. Effect of organic fungicides on burr development.

Stylet Oil had the most drastic affect, causing significant damage to the hop plant, resulting in chlorosis and leaf margin necrosis.

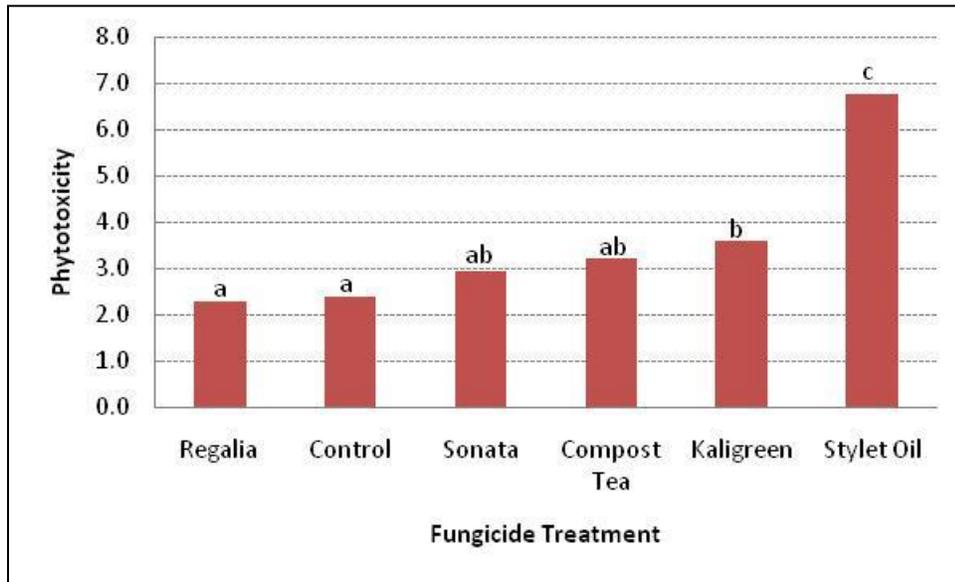


Figure 2. Phytotoxicity resulting from organic fungicides and mite damage.

It is well documented that some fungicides (sulfur and petroleum oils, for example) can have an adverse effect on the arthropod natural enemies of spider mites resulting in mite outbreaks. We certainly found this to be the case with this trial. Stylet Oil and Kaligreen had the most mite damage, whereas Regalia and compost tea had mite damage comparable to the control.

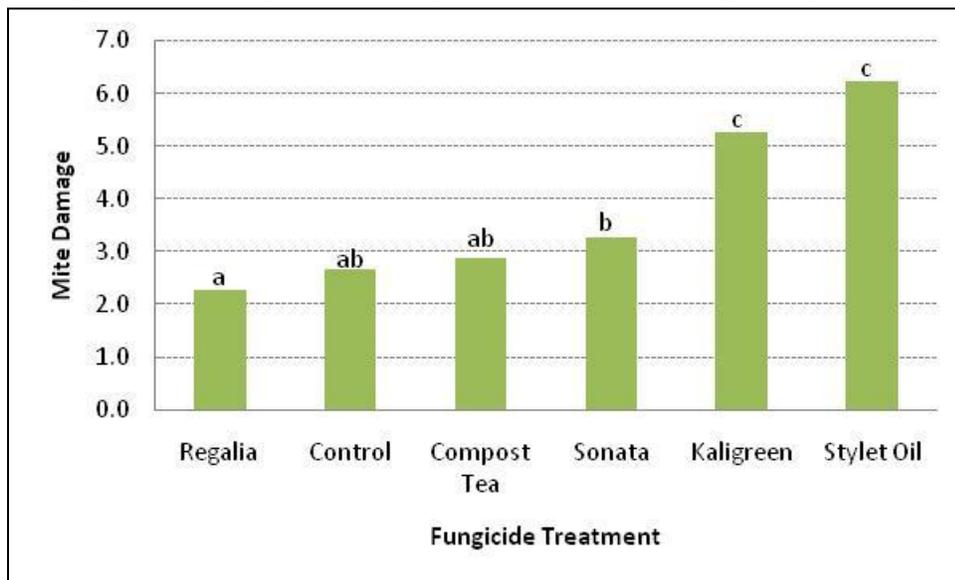


Figure 3. Mite damage as a result of fungicide treatments.

Since most hop growers in the Northeast are interested in organic or “softer” approaches to pest management more research needs to be conducted to evaluate organically approved pest products.

Leafhopper Prevalence in Variety Trial

The research hopyard has allowed our group to collect other relevant and important data. This has included pest and beneficial insect data. This season leafhopper damage to hops was documented. This is not a pest in the PNW and hence there is little data or outreach available on the topic. The

Variety	Leafhoppers per leaf	Significance
Tettnang	0.42	a
Centennial	0.75	ab
Willamette	0.75	ab
Fuggle	1.58	abc
Perle	1.67	abc
Cluster	1.83	abcd
Chinook	1.92	abcd
Glacier	2.33	abcde
Sterling	2.33	abcde
Nugget	2.67	abcde
Galena	3.08	bcde
Casade	3.42	cde
Vanguard	3.58	cdef
Santiam	3.83	cdefge
Liberty	4.33	defgh
Crystal	4.58	efgh
Newport	6.00	fgh
Mt. Hood	6.25	gh
Saaz	6.58	h
LSD (0.10)	2.50	
Hopyard average	3.05	

hopyard enabled us the opportunity to collect this data and will help us develop additional research proposals. Our hopyard is located in an alfalfa field, and leafhopper damage was first noticed after the first alfalfa cut. Upon scouting the hopyard for pests and diseases, the infestation levels were determined to be economically significant. We found there is a significant difference between levels of leafhoppers between varieties ($p < 0.10$) which suggests this pest has a preference for certain varieties over others. The varieties responded the same across all sample dates which means there is a true difference in the level of leafhoppers between varieties that was not influenced by the sample date ($p < 0.10$).

At this time it is unknown what draws leafhoppers to certain varieties or perhaps repels them from another. It may be due to the plant morphology as with certain leafhopper resistant alfalfa varieties which have leaf glands and hairs that make them undesirable to leafhoppers. Saaz exhibited the highest average of leafhoppers per leaf across the four

sample dates while Tettnang had the lowest. We have several hypotheses as to what characteristics of the hop plant drive this trend, such as genetic differences, alpha acid levels, or nutrient levels in the hop. However, further research is needed to study and evaluate the leafhopper and its patterns before any conclusions can be drawn or recommendations made.

Hop Outreach and Education

A goal of this program is to provide potential, new, and established hop growers with high quality and relevant educational resources. A variety of educational resources and outreach events has been implemented throughout the project and are described below.

Since fall of 2009, UVM Extension has worked hard to promote small scale hops production in Vermont. As outlined in the grant, we held our first annual Advisory Committee, in October of 2009, bringing together 32 hop enthusiasts, including hop growers, those interested in growing, brewers, and agency personnel. Roundtable discussions ensued, highlighting needs and expectations from both brewers and growers, such as the importance of hops pelletization,

packaging properly to preserve quality, and varietal availability from the brewers, and infrastructure needs from growers such as harvest machinery, agronomic advice, and pest control. In late 2010, a New England subchapter of the Northeast Hops Alliance (NEHA) was formed and voted into the bylaws. The New England Chapter has a board consisting of brewers and farmers from MA and VT. This group now serves as an advisory committee.

A HOP WEBSITE (www.uvm.edu/extension/cropsoil/hops/) was created as part of this project. The UVM Extension Crops and Soils Hops Page presents information on hop production collated from all over the country, interspersed with UVM Extension updates, research, and conference proceedings. The Hop Page is host to the Brewer Survey, a continuation of Rosalie Wilson's work on collecting data from New England brewers on their needs and wants from local hops producers. The Hop Page also hosts the Grower Survey, which surveys visitors on their hop production methodologies. The purpose of the Grower Survey is to collect data on the most common hop production practices in the Northeast, and identify problem areas and areas that are in need of improvement. The surveys were a result of this project and are attached to the report. Several bulletins on hops fertility management, hop trellis construction costs, organic fungicides in hops, and pest and beneficial insect updates have all been published on the UVM Extension Crops and Soils webpage.

UVM Extension Crops and Soils Program Hops Page: www.uvm.edu/extension/cropsoil/hops

- Fertility Guidelines for Hops in the Northeast - <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/HopFertilityManagementNE.pdf>
- Organic Fungicides on Hops - <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/organic-fungicides-and-hops.pdf>
- Potato Leafhopper Damage in Hopyards - http://www.uvm.edu/extension/cropsoil/wp-content/uploads/Leaf_Hopper_Article.pdf
- Managing Powdery Mildew of Hops in the Northeast - <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/PowderyMildew.pdf>
- Borderview Farm Hopyard Construction Costs - <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/Hopyard-labor-materials-costs.pdf>
- Borderview Farm Hopyard Irrigation System - <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/Hopyard-irrigation-materials-costs.pdf>

Three YouTube videos were produced that detailed the construction of the hopyard, and are available on the UVM Extension Crops and Soils YouTube Channel: <http://www.youtube.com/user/cropsoilsvteam>. Constructing a Hopyard, Parts 1-3 have a total of 12,947 views. A crop camera was placed in the hopyard this year, snapping photos every hour throughout the growing season. The Hop Cam video that was a result of this project can also be found on the UVM Extension Crops and Soils YouTube Channel.

UVM Extension Crops and Soils YouTube Channel: <http://www.youtube.com/user/cropsoilsvteam>

- Constructing a Hopyard Part 1 - <http://www.youtube.com/watch?v=vPF7QlVGgtA&list=UU7sh59UG2pKqfmPMfaVxpbA&index=26&feature=plcp>
- Constructing a Hopyard Part 2 - <http://www.youtube.com/watch?v=QrRIyWlZTTs&list=UU7sh59UG2pKqfmPMfaVxpbA&index=25&feature=plcp>
- Constructing a Hopyard Part 3 - <http://www.youtube.com/watch?v=P0f00qwoKGM&list=UU7sh59UG2pKqfmPMfaVxpbA&index=17&feature=plcp>

The UVM Extension hops blog “What’s Hoppening”, hosted on the UVM Extension Crops and Soils website, has 177 subscribers, and 34 posts. A webpage on the UVM Extension Northwest Crops and Soils Program website has been devoted to hops, and has 2924 visits. UVM Extension Crops and Soils hops blog “What’s Hoppening”: <http://www.uvm.edu/extension/cropsoil/whats-hoppening>

Sample Pest Posts:

- Hop Pest – Eastern Comma: <http://www.uvm.edu/extension/cropsoil/hop-pest-eastern-comma>
- Spider Mite Destroyers and Spined Soldier Bugs: <http://www.uvm.edu/extension/cropsoil/spider-mite-destroyers-and-spined-soldier-bugs>

Sample Hop-News posts:

- Northeast Hop Alliance Fall Hop Conference and Annual Meeting - <http://www.uvm.edu/extension/cropsoil/neha-fall-hop-conference-and-annual-meeting>
- Hop processing equipment for sale - <http://www.uvm.edu/extension/cropsoil/hop-processing-equipment-for-sale>
- Hops Recordkeeping Booklet - <http://www.uvm.edu/extension/cropsoil/hops-recordkeeping-booklet>

During the project period, UVM Extension has hosted two hops conferences, with a combined total of over 200 attendees. Six on-farm field days were held in Vermont and Massachusetts with more than 500 attendees. Conference proceedings can be found at <http://www.uvm.edu/extension/cropsoil/hops>.

Twelve on-farm visits were conducted in MA and VT. Sixty phone calls were fielded from hop growers and those interested in growing hops in MA and VT over the project period. Over 150 emails were answered with hops questions from growers, brewers, and other interested parties. Questions answered included a broad range of categories including but not limited to pest management, fertility management, pest identification, feasibility, and hop production basics.

In January 2010, Dr. Heather Darby was a presenter at the NOFA-NY winter conference. The presentation was focused on basic hop production. There were 60 attendees.

In January 2010, Dr. Heather Darby was a presenter at the NH Farm and Forest Exposition. The presentation was focused on basic hop production. There were 52 attendees.

In March 2010, Dr. Heather Darby and Rosalie Madden were the guest speakers at the Vermont Brewers Association Annual Meeting. They discussed hops and malting barley, and the challenges that local growers face, and the importance of forming close relationships between farmers and brewers.

March 2010, Rosalie Madden presented at the Northern Grain Growers Annual Conference on hops production in the Northeast, and Andrea and Christian Stanley, of Valley Malt in Hadley, MA presented on growing and processing malting barley.

The UVM Extension research hopyard was planted in the late summer of 2010, and a subsequent field day was held, with over 200 attendees, highlighting hopyard construction.

A field day was held in Northfield, MA on August 26th, 2010 at Four Star Farms, with 37 attendees. The field day focused on hops production, with attention paid to UVM Extension on organic fungicides in hops, and the results of Rosalie Wilson's survey of New England breweries.

In September 2010, UVM Extension Agronomist Dr. Heather Darby, UVM Extension Crops and Soils Technician Rosalie Madden, and hop farmer Roger Rainville travelled to Yakima Valley, WA to learn more about hops production. There they networked with growers and hops researchers, learning about conventional and organic hops production, cover cropping efforts in the Pacific Northwest, low-trellis hops production, and hops breeding. From that trip, a YouTube video was made of a Wolf Harvester, a hops harvester designed for small-scale production. Photos and experiences from this trip have been shared with constituents at hop field days and in hop presentations at conferences.

- UVM Extension and the Wolf Harvester - <http://www.youtube.com/watch?v=LMxRcN2mTF0&list=UU7sh59UG2pKqfmPMfaVxpbA&index=16&feature=plcp>

In November of 2010, a Hops 101 and 201 workshop was held in Cooperstown, NY. This workshop was held to educate potential hops growers on all aspects of growing hops from field prep and soil fertility to pest management, harvesting, and processing. 60 participants attended Hops 101, and 42 participants attended Hops 201, with some participants attending only one of the two courses. UVM Extension provided 7 scholarships to farmers from VT and MA. Hops are a historical crop in the Northeast, and much of the knowledge on how to grow this crop has been lost in the last 100 years, creating a large knowledge gap on how to successfully and economically raise this crop. Many growers are interested in getting into hops production, but are diving in blind. Overall response to the workshop was very favorable, and to quote one recipient, "It's good to know what I'm getting myself into." The guest speakers that were contracted to run the workshop are experts in growing hops on a small scale in Wisconsin, and the workshop was made possible through co-sponsorship by the Vermont Agency of Agriculture, Food & Markets, UVM Extension, Cornell

Extension, the Northeast Hops Alliance, the New York State Brewers Association, Atlantic Hops, Madison AED, Gorst Valley Hops, and Ommegang Brewery.

In the 2011 growing season, a hops field day was held on July 8th at Square Nail Hops, a hops farm in Ferrisburgh, VT, with 30 attendees. This field day looked at alternate methods of hopyard construction and trellising design. Also highlighted was fertility management in first year hops production. Local brewers were given the opportunity to discuss their needs and desires in local hops production.

The research hopyard was featured in the annual Crops and Soils Field day at Borderview Research Farm on August 4th, 2011. There were 225 attendees. Hop pests were discussed, featuring UVM Extension's discoveries of potato leafhopper hop varietal preferences.

Dr. Heather Darby presented at the Northeast Hop Alliance Fall Conference in November, 2011, highlighting proper techniques and considerations for soil preparation in a hopyard and fertility recommendations to over 170 interested hop growers from all over the Northeast.

In November 2011, Dr. Heather Darby, with assistance from Mark Magiera, brewmaster for Bobcat Café and Brewery in Bristol, VT, presented to 90 brewers at the Vermont Brewers Association Sensory Analysis Conference, highlighting the advantages of local hops, and the unique brewing characteristics offered from a regional product.

An article on "Organic Hop Production" was developed and published in Agronomy Journal. Samuel F. Turner, Chris A. Benedict, Heather Darby, Lori A. Hoagland, Peter Simonson, J. Robert Serrine and Kevin M. Murphy. 2011. **Challenges and Opportunities for Organic Hop Production in the United States**. Agronomy Journal 2011 103: 6: 1645-1654.

A review article on "Low Trellis Hops Production" has been developed and is being reviewed by colleagues in Michigan and Washington. The article slated for publication in the Journal of Horticulture Science.

GOALS AND OUTCOMES ACHIEVED

The UVM Extension research hopyard has led to an initial report on the suitability of commercially available hop varieties to the Northeastern climate. As hops are a perennial crop, future research is needed to determine the suitability of these varieties over time, as the plants mature and as they are exposed to different pest and disease cycles. Through this initial funding we were also able to conduct preliminary trials on organic pest controls. Scouting data collected in the hopyard has also lead to the discovery of varietal trends in potato leafhopper predation, something that has previously not been researched. Future work is needed with this particular pest, but also with hop pests in general. Pests that attack hops in the Northeast are different than those that are an economic threat in the Pacific Northwest. Through regular scouting in the experimental hopyard pests and diseases are being identified and information is shared with growers through our web

resources. The goal was to develop local and relevant research for Northeast hop growers. The outcome from this project is the establishment of a research hopyard and the initiation of a variety trial. In addition, the hopyard has allowed us to collect valuable information on fertility and pest issues in hopyards. Lastly, we are advisers to 3 growers that were awarded USDA SARE Farmer Grants to investigate fertility, trellis design, and harvesting questions on-farm.

The goal was to develop relevant and practical educational programs and material. The outcome has been the development of a diverse array of materials and events that have been accessed by more than 1000 stakeholders. Based on post conference survey data we have found that stakeholders are improving their hopyard production by accessing the materials. Future work needs to be done to document long term impact of the hops outreach program.

The annual Winter Hops Conference was full to capacity in both 2010 and 2011, with over 100 participants each year, bringing together brewers, hop growers, and those interested in hops. In 2010, Jason Perrault, a fourth generation hop farmer and hops geneticist was featured, and he gave an overview of hops production and hops breeding. Rick Pedersen from Pedersen Farms in Seneca Castle, NY has been growing hops for over a decade, along with over 1000 acres of vegetables. He shared his knowledge and experience on producing hops in the Northeast. Also invited was Francois Biron from the Quebec Ministry of Agriculture, Fisheries, and Food, and he discussed the work that is being conducted in Quebec on hops production. Allen Van Anda, the brewmaster at Trapp Family Brewery spoke about his experience with whole leaf hops and shared his enthusiasm for locally sourced hops. Of the attendees that responded to post conference surveys, 52% claimed to be currently growing hops, and 41% were interested in growing hops on a commercial scale. As a result of the conference, 38% of those polled intend to start growing hops, 36% intend to increase their hops production acreage, 25% will improve their pest management, 28% will improve their fertility management, and 23% will be able to more successfully market their hops. 83% stated that they felt they had better access to hops related information.

The 2011 Winter Hops Conference featured Dr. John Henning from Oregon State University, and he discussed disease management, hops genetics, and low-trellis hops production. Adam Krakowski has been working with the Vermont Historical Society, researching historical hops production in Vermont. He shared his findings with the audience. Roger Rainville, owner and operator of Borderview Farm, home of the UVM Extension research hopyard, gave a detailed talk on hopyard construction, highlighting construction materials and costs. A Brewer Panel was also formed, and opened to audience questions. The Panel included Mark Magiera from Bobcat Café and Brewery in Bristol, VT; Mike Gerhart, brewmaster at Otter Creek Brewing and Wolaver's Organics; Allen Van Anda, brewmaster at Trapp Family Brewery; and Matt Cohen from Fiddlehead Brewing. Of the attendees surveyed at the 2011 Winter Hops Conference, 44% were currently growing hops, and another 44% were interested in growing hops. 100% stated that the conference was "good" to "excellent". Each speaker was found by the audience to be informative and interesting, and all of the speakers inspired the audience to learn more.

BENEFICIARIES

The several hundred attendees at hop related events, and the several thousand viewers of hops YouTube videos and visitors of the UVM Extension Crops and Soils Hops Page are the beneficiaries of this project. The Northeast Hops Alliance and the New England chapter of the Northeast Hop Alliance are also beneficiaries as they have had the opportunity to access regionally based hops related research, and have had a hand in guiding the research conducted by UVM Extension. These beneficiaries include potential, new, and established hop growers throughout the US and Canada. Additional beneficiaries include other agricultural professionals such as Extension staff, University professors, and US or state government employees. The brewers of Vermont and Massachusetts have also been and will continue to be important beneficiaries as they now have broader access to locally produced hops.

As a result of this project as well as collaborative efforts with other organizations (NEHA, Cornell University), 6 breweries in Vermont and 8 breweries in Massachusetts, and numerous breweries in Maine, New Hampshire, and New York are now purchasing local hops.

There have been 12 new commercial hop producers (New England and Eastern Canada) as a result of this project and collaborative efforts with other organizations. Based on our close interaction with these producers we have been able to assist them with production information. One of the producers commented “I have always wanted to grow hops but never felt like I would have the support or information I would need to be successful”. With your program I now feel confident to implement my new crop”. Most of these new growers have just established yards in 2011 or will establish in 2012. Hops produced on first year plants for all new farmers were quickly purchased by eager brewers. One brewer commented “that he wanted to use local hops but he wasn’t able to find any”.

LESSONS LEARNED

Lessons learned by the project staff are numerous. The best way to be able to help producers is to “do it ourselves” so we can really know the production challenges that are being faced by growers. The experimental hopyard is helping us collect valuable data but also allowing us to “experience” hops just like a grower. Through this process we are able to alert growers when pests arrive and/or share our mistakes with new growers.

Hops are a complex crop. There are significant startup costs, both economically and in time and labor. Constituents have commented how invaluable they have found the Building a Hopyard YouTube videos and construction costs fact sheets, and how much they have appreciated the opportunity to be able to visit a hopyard prior to constructing one themselves.

Variety selection is a major decision, and we are proud to be able to offer some baseline data on variety suitability through our research. Hops are very disease susceptible, particularly to downy mildew, which is a consideration that every grower should be undertaking, but other pest factors

seem to be worth consideration as well. There are numerous hop pests and beneficial insects specific to the Northeast that are not found in the main hops production areas of the world. Further work is certainly needed in this domain. Planting varieties that don't thrive or yield well in this climate is economically unsound. Our first year harvest data is an indicator of the potential of each of the 20 varieties trialed, but as hops take three years to reach peak production, further research is needed.

Small-scale infrastructure is a continued stumbling block in hops production in the Northeast. The mobile hop harvester designed courtesy of a SCBGP grant has taken steps to alleviate this issue, as has UVM Extension's work with small-scale hops balers and oasts. The future bears great promise once these works have been completed and made publicly available.

CONTACT PERSON

Dr. Heather Darby, UVM Extension Agronomist, (802) 524-6501, heather.darby@uvm.edu

PROJECT 9: Vermont Christmas Tree Industry Marketing – Previously Accepted

ACTIVITIES PERFORMED

The New Hampshire-Vermont Christmas Tree Association has some 200 members and represents the majority of tree growers in the two state area. A primary NHVTCTA goal is to assist members in the marketing of their product in light of ever increasing pressures from artificial trees and real trees from other areas of the country and Canada. NHVTCTA has maintained a web site for several years to assist in this marketing; the goal of this project was to update and refresh the site. In order to respond to new technologies and opportunities, the Association acknowledged the need for a mobile marketing website and a social media marketing campaign.

The Vermont Christmas Tree Association also contributed to the marketing effort on behalf of its members, by representing the industry at trade shows and spearheading an advertising campaign.

PROJECT APPROACH

The NHVTCTA website has been completely redone, with an emphasis on the consumer. All new photographs and text have been developed, and ease of navigation has been accomplished. A new mobile marketing website has been developed. And a social marketing campaign through Facebook was maintained through the September-December marketing period. This was accomplished through the assistance of an outside contractor. Members of NHVTCTA assisted through the identification and use of in-house photography and through review of text. NHVTCTA made every effort to reach out to Association members and to have them list their farms on our web site, and to provide linkage to their individual farm websites where appropriate.

During 2010 the VCTA conducted the following activities:

1. Attend the Penn Atlantic Nursery Trade Show (PANTS) in Philadelphia. This show is specific for garden centers and others that retail Christmas Trees in the major Metro areas of the East Coast (8 to 10 million trees annually) Approximately 10,000 attend the show.
2. Advertising in the Country Folks Grower newspaper, a monthly publication to 65,000 most of which retail Christmas Trees.
3. Maintain a booth for 3 days in the Vermont Building of the Eastern States Exposition. Estimate 200,000 consumers viewed our booth.

GOALS AND OUTCOMES ACHIEVED

As a result of the NHVTCTA website update, almost 90 individual farms have chosen to list their farms and their products on the new website. This is an increase of some ten percent in the number of farms that have been listed. In cases where farms have their own website, this provides direct linkage to their site through the NHVTCTA website. Preliminary indications are that wholesale sales have been strong in the face of increasing competition. The number of hits to our new website has also increased by over 10 percent, giving us preliminary information that various search engines are identifying our site with more regularity.

All three VCTA initiatives reached expectations of exposure to customers. Booths were manned by representatives of our Association at all times. We were able to get a few price breaks at the PANTS show which reduced our total cost for the project.

Results: Members reporting all sold out of trees for the 2010 season. No question that there was a downward pressure on wholesale prices. Most of this appeared to be caused by the economy, nervous retailers and a few wholesalers willing to reduce prices. Reports from the field, NY area in particular, were that retail was very strong. Some growers reported the best year in three years with no need for price reductions. Fraser fir from North Carolina is competing in our market area.

All our projects have been designed to increase to increase traffic on our web site. Google Analytics reported that our hits on the web site increased over **four** times last year at the same time (November to December), or 125 hits per week in 2009 up to 500 on the busiest week in 2010 season. This is very positive proof that our marketing projects worked. There is virtually no limit to this success in the future.

BENEFICIARIES

The primary beneficiaries of this effort are the approximately 500 Christmas tree and wreath producers in Vermont and New Hampshire. This will ultimately be measured through sales volume, pricing and profitability. Secondary beneficiaries will be the consuming public, who will more easily be able to locate a product or a farm, obtain a quality, fresh product and experience an enhanced shopping experience. The ultimate measurability of these goals will only be possible in the long term when sales and profitability data become available as part of the next Census of Agriculture.

LESSONS LEARNED

From the inception, it was apparent that NHVTCTA did not have the expertise to handle this project in a professional manner in-house. We attempted to minimize costs through the use of in-house photography. While we were able to do that without compromising the quality of the final product, it was only done with the greatest of effort. If “a picture is indeed worth a thousand words”, then it is important in the future for NHVTCTA to develop the resources to have professional photography for future marketing efforts.

The Agency has requested that the VCTA develop a survey for wholesale Christmas Tree growers to gauge their perception of tradeshow attendance.

CONTACT

James Horst, Executive Director, New Hampshire Christmas Tree Association, (802) 447-1900, info@nh-vtchristmastree.org

ADDITIONAL INFORMATION

WEBSITE – Website can be viewed at www.nh-vtchristmastree.org

PROJECT 10: Farm-to-Table Delivery Program – Previously Accepted

PROJECT SUMMARY

Farm-to-Table is a program of Food Works at Two Rivers Center. It is a year-round farming and local foods delivery and education program, dedicated to paying farmers a fair market price for their products, to supporting their annual operations by collectively planning production and sales, and by linking them directly to new market opportunities that show a rapidly growing demand for fresh, local produce – particularly underserved populations. Farm-to-Table is a unique model in that it combines creating a new option for local foods distribution, providing markets for new farmers, and bringing local foods to low income Vermonters, school children, senior citizens, and clients of social service agencies and health facilities. Farmers utilized by the program are almost entirely vegetable growers eligible as specialty crop producers. Non-specialty crops (eggs, yogurt, oats, etc) accounted for approximately 12% of Farm-to-Table sales in 2010; other funding sources were used to support this.

Two clear objectives are addressed by this program: 1) increasing the economic viability of small-scale vegetable farming in Vermont by opening up new markets to growers; and 2) increasing low-income Vermonters’ access to healthy, fresh, local foods.

PROJECT APPROACH

Farm-to-Table has just completed its most successful year ever, in purely quantitative terms, having exceeded \$106,000 in sales to recipient sites, a 28% increase over 2009. Perhaps more importantly, it has also laid a foundation for its future growth, not merely in broadening its base and increasing its sales, but also in deepening and furthering its educational and social justice mission. Three factors have contributed to this growth in the program's capacity, and they are listed below in chronological order:

- The completion of a business plan, with the assistance of a grant from the Vermont Farm Viability Enhancement Program.
- The hiring of a part-time Farm-to-Table Educator this fall, who is now providing outreach and assistance to the neediest of the recipient sites (namely, the food pantries).
- The furthering of Food Works' partnership with the Central Vermont Community Action Council. The two organizations are now in the last stages of an official merger. This move will help strengthen and stabilize all of Food Works' programs, including of course Farm-to-Table.

In terms of summarizing the program's activities of the past year, the following may be offered as significant highlights:

- Planning meetings among the primary growers saw an improvement in both process and outcome, and increased leadership among the growers themselves. Growers reported being very pleased by the honesty and transparency of the discussions, and the resultant letters of agreement between the program and each grower, which individualized sales goals as well as production schedules. Plans for the program's purchase of storage crops received much attention, and were much more highly refined than the previous year. The primary growers also have become more involved in determining marketing strategies.
- Sales for the winter months rose nearly 50% over 2009, due in great part to the use of our new root cellar and distribution center at the Two Rivers Center.
- A summer intern from UVM helped to promote our buying clubs and start new ones, as well as offer technical assistance. By the end of the year, five new buying clubs were created.
- Sales to the "commercial customer base" virtually **tripled**. This term indicates those sites not serving the low-income communities per se, and who pay a 10% mark-up over the farmers' prices, to help support the costs of the program itself. Four new commercial customers were established, and significant efforts were made to increase sales to the New England Culinary Institute (NECI). These efforts proved successful, and another meeting with NECI chefs is planned for this winter, in order to further collaboration.
- The newly hired, part-time educator and assistant began a program of weekly food demonstrations at the CVCAC food shelf this fall, with the aim of educating and encouraging people to use the fresh produce which now is more frequently available there (in part due to Farm-to-Table, as well as the farm at Food Works' Two Rivers Center).
- Attendance at our annual Chef-Farmer Retreat in December reached an all-time high, and the well-received morning workshops brought together an extremely diverse range of people from 18 of our recipient sites to explore issues of cooking with local foods, seasonal menu planning,

nutrition, and winter-time health. The keynote speaker, who addressed the day's theme of "Rediscovering our Roots," was one of the primary Farm-to-Table growers.

GOALS AND OUTCOMES ACHIEVED

The three goals as outlined in the Farm-to-Table proposal were:

1. Furthering education of new sites and new farmers
2. Strengthening the program's financial plan
3. Performing outreach around the program as a model

Towards achieving these goals, and meeting the outcome measures as specified, these were some of the program's many activities:

Furthering education of new sites and new farmers:

- The Chef-Farmer Retreat, a day-long educational event held in December, drew approximately 40 people, the majority of whom were chefs, teachers, or volunteers from participating sites. Half of these were attending for the first time, and three of them were from sites which had never sent representatives before. Completed written evaluations from site participants were 100% positive. In particular, participants mentioned the usefulness of the workshops, and indicated enthusiasm for using the new recipes and new cooking methods introduced. Sales of root crops increased immediately following the retreat.
- A half-day retreat for the spring of 2011 is being planned, to include workshops suggested by participants at the December retreat. (Unfortunately, no spring retreat was held in 2010, due to Food Works staffing shortages.)
- A new program of weekly food demonstrations (utilizing vegetables from Farm-to-Table) at area emergency food pantries began in the fall, and is continuing.
- The goal of adding three new farmers to the program has not been fully met to date, but progress is still being made towards that goal. One new farm joined the Farm-to-Table network as a regular supplemental grower, beginning in December. The farmers, Seth and Jeannette Johnson of Glover, are themselves new to commercial growing, and are meeting a critical need by providing Farm-to-Table with dried beans. Another arrangement is also being made with one of the larger organic vegetable growers in the area (Riverside Farm of Hardwick) to supply the program with onions, and perhaps other storage crops, for next season. The strong growth in demand for root crops from the recipient sites has necessitated this move, as there are current shortages.
- Production planning meetings with the primary growers were highly successful last winter, and that model is currently being built upon as the 2011 season is being planned. Draft plans are circulated electronically prior to meetings, more accurate estimates of need are being generated, etc. Last winter, at the growers' initiative, a second meeting was called for and held regarding marketing strategies. Leadership has emerged within this highly committed group of growers, and the spirit and practice of collaboration has only increased over time.

Furthermore, more experienced growers among the group are sharing their expertise with younger growers.

Strengthening the program's financial plan:

- A five-year business plan was completed, with the assistance of business consultant Rosalie Wilson, funded by a grant from the Vermont Farm Viability Enhancement Program. The plan details how the growth of Farm-to-Table's commercial customer base can make possible a lessening of dependence on grant money, while maintaining the program's commitment to providing subsidies to low-income populations. Specifically, the plan projects that by 2013, grant funding will account for only 28% of total program income, the rest to be generated by sales and fees (for instance, storage rental and workshop attendance). By way of contrast, in 2009, grant funding accounted for 53% of total program income.
- Sales to the commercial customer base exceeded their target, and very nearly tripled over the previous year. In 2009, \$7,148 was purchased by workplace cafeterias, restaurants, caterers, and institutes of higher learning; in 2010, \$20,911 was purchased by these customers. Because this category of purchasers pays at a higher rate than the schools, hospitals, senior centers, and social service agencies for whom Farm-to-Table was created to serve, these sales actually generate revenue for the program and enhance its financial viability.
- Additionally, sales to community buying clubs grew by 82%. In 2009, \$7,052 worth of food was purchased by community buying clubs; in 2010, \$12,879 was purchased. These purchasers currently pay the same mark-up (10%) as the aforementioned category of commercial customers, and also help to generate income for the program. Five new active buying clubs were established, exactly meeting the target for the year.

Performing outreach around the program as a model

- Farm-to-Table's business plan is now ready to be shared with any organization wishing to follow its model.
- Food Works staff (including the Farm-to-Table coordinator) actively participated in the work done by the Vermont Sustainable Jobs Fund in preparation for the statewide Farm-to-Plate Strategic Plan. Farm-to-Table reports and data were freely shared with co-author Virginia Nickerson.
- Food Works staff are actively involved in VT-FEED and the Vermont Regional Food Centers Collaborative, and share news, information, and reports from Farm-to-Table around the state.
- The Farm-to-Table coordinator has shared reports and informally consulted with activists from Addison County who are working towards forming a similar community-based local foods distribution network.

BENEFICIARIES

The primary beneficiaries of the Farm-to-Table program, are, of course the children, seniors, and others dining at the recipient sites, who benefit nutritionally from eating fresh, local produce. Also benefiting are the growers and producers who see sales rise due to this new market.

The following is a list of the recipient sites served by Food Works' Farm-to-Table Program in 2010. The total number of sites served was 59, and the combined total value of the food they received was \$106,117. The value of food purchased by each site category is listed next to each heading.

Schools (14): \$29,426

Barre City Schools (BCEMS and Spaulding High School) Barre Town Elementary/Middle School
 Berlin Elementary School
 Cabot Village School
 Calais Elementary School
 Doty Elementary School, Worcester
 East Montpelier Elementary School
 Harwood Union High School, Duxbury
 Montpelier Public Schools
 Northfield/Roxbury Schools
 Rumney Elementary School, Middlesex
 Twinfield Union School, Marshfield
 U32 High School, East Montpelier
 Walden Elementary School

Hospitals (2): \$4,445

Central Vermont Medical Center, Berlin
 Vermont State Hospital, Waterbury

Senior Congregate Meal Sites and Adult Day Programs (8): \$9,727

The Galley, Barre
 Mad River Valley Senior Center, Waitsfield
 Montpelier Senior Meals Program
 Northfield Senior Center
 Project Independence, Barre
 St. Johnsbury Senior Meals Program
 Twin Valley Senior Center, Marshfield
 Waterbury Area Senior Center

Community Mental Health Sites (6): \$7,800

Kirby House, Waterbury
 WCMHS: Arioli House, Barre
 WCMHS: Sunrise Recovery Center, Montpelier
 WCMHS: Segue House, Montpelier
 WCMHS: Single Steps, Montpelier
 Second Spring, Williamstown

Early Childhood Programs (2): \$2,238

Family Center of Washington County, Montpelier
 Head Start @ Brook Street School (CVCAC), Barre

Other Social Service (1): \$38

Return House, Barre

Emergency Food Shelves and Soup Kitchens (7): \$10,684

CVCAC Emergency Food Shelf, Barre/Berlin
Montpelier Food Pantry
Roxbury Food Shelf
Onion River Food Shelf, Marshfield
Mad River Valley Food Shelf, Waitsfield
St. Augustine Church Soup Kitchen, Montpelier
Hedding Methodist Church Soup Kitchen and Pantry, Barre

Community Buying Clubs (8): \$12,870

Calais School Buying Club
Doty School Buying Club
Foodbank Buying Club
Maple Corners Buying Club
Montpelier Buying Club
Rumney School Buying Club
Stone Environmental Buying Club
Worcester Buying Club

Commercial Customers and Higher Education (8): \$20,911

Adamant Coop, Calais
Fair Food Farm Store, East Calais
Farmhouse Café and Catering, East Calais
Goddard College, Plainfield
Joe Buley Soups, East Montpelier
NECI @ National Life Cafeteria, Montpelier
NECI @ Main Street Bar and Grill, Montpelier
Vermont Fiddle Heads, Worcester
Yestermorrow Design/Build School, Waitsfield

Food Works' Educational Programs (3): \$1,910

Gardens for Learning Camps:

Two Rivers Center, Barre City Elementary/Middle School, Highgate Apts., Green Acres Apts., Roxbury Roots

Good Food, Good Medicine Courses:

Highgate and Green Acres Housing Developments, Barre City

VT-FEED (and other teacher training activities):

Barre City, Cabot, and Randolph schools

Food Works' Staff and Vounteers: \$5,675

The following is a list of the growers and producers who sold their products to Farm-to-Table in 2010, for a total value of \$108,595. (The difference between the amount purchased from the growers and the amount distributed to the sites may be accounted for by the increased purchase of storage crops in the fall of 2010, as compared to the amount purchased in the fall of 2009.)

The primary growers, with whom pre-season agreements were made specifying targeted sales figures, are marked by asterisks. Other major growers and producers are marked by a plus sign. The remainder are back-up or supplemental growers or producers. The total number of growers who sold products to Farm-to-Table in 2010 was 21. As mentioned earlier, a significant new grower of dried beans has just been engaged for 2011, and discussions are underway with several other new growers, so the total continues to grow.

*Mimi Arnstein/Wellspring Farm (Marshfield)
 *Paul Betz and Kate Camilletti/High Ledge Farm (Woodbury)
 *Lee Blackwell and Ruth Richards/Blackwell Roots (Cabot)
 *Joe Buley/Screamin' Ridge Farm (East Montpelier)
 *Bill Half/Harvest Hill Farm (Walden)
 *Dave Hartshorn/Hartshorn Farm (Waitsfield)
 *Joey Klein/Littlewood Farm (Plainfield)
 *Chip Allen Natvig/Pebble Brook Farm (Northfield)
 *Robin Taylor (Marshfield)
 +Bill Suhr/Champlain Orchards (Shoreham)
 +George Gross/Dog River Farm (Berlin)
 +Lazor Family/Butterworks Farm (Westfield)
 Peter Johnson/Pete's Greens (Craftsbury)
 Barb and Bob Chappelle/Chappelle's Vermont Potatoes (Williamstown)
 Richard Wiswall and Sally Colman/Cate Farm (East Montpelier)
 Michel Gaudreau/Golden Crops (Compton, Quebec)
 Thea and Alexander Schwartz (Middlesex)
 Rhapsody Natural Foods (Montpelier)
 Vermont Smoke and Cure (Barre)
 Jane Eakin (Calais)
 Murad Ilyasov (Waterbury)

While it is not possible to quantify the exact economic benefit to these growers and producers of selling to the Farm-to-Table program, it should be noted that the vast majority of the recipient sites would not have purchased locally (or at least not anywhere near the amount they did) without the program. Therefore, collectively, the impact to these growers was likely over \$100,000 in sales. Potentially, if the program can develop the capacity to meet the growing demand for local food, the impact will be much greater. The rapid expansion of the Farm-to-Table program has made evident the need for more growers and producers in Central Vermont. Each year that it has been in

existence (it is now entering its seventh full season), primary growers have increased their acreage and put up new greenhouses, in direct response to the demand the program has created.

LESSONS LEARNED

The Farm-to-Table program begins 2011 in a much stronger position than it began 2010. This is partly due to better financial planning and more diversified funding sources, including an increase in program-generated revenue. It is also due to the organizational partnership (soon to be merger) between Food Works and CVCAC, which will in the long run increase both the financial stability, as well as the outreach and educational opportunities, of all of Food Works' many intersecting programs. However, the strength of Farm-to-Table is also due to the commitment of the primary growers to working collaboratively on production planning and marketing strategies

Reflecting on the experience of this past year, however, brings several critical issues to the fore: First and foremost, the rapid expansion of sales (and the volume of product) strained the capacity of program staff, especially in the fall months. The planned increase in work processing parties, and consequent expanded availability of "lightly processed" products, did not occur, due to limitations in capacity. Likewise, the proposed increase in statewide outreach and modeling of the program did not occur. It is becoming increasingly evident that a new staff position will soon be necessary, although the current budget does not provide for this. In concert with our new partners at CVCAC, we are actively exploring new funding sources.

An unexpected outcome also occurred as a result of achieving one of the more specific proposed goals; namely, the increase in the number of community buying clubs. The creation of five new buying clubs in the summer and fall months put an enormous burden on staff and volunteers filling the orders on delivery days. An evaluation of the cost effectiveness of the current buying club pricing structure needs to be made. Between the growth of the buying clubs and the vastly increased sales to the rest of the commercial customer base (workplace and college cafeterias, etc.), it may soon be necessary to revamp the packing, delivery, and billing procedures that have been in place since the inception of the program. In short, an "upgrade" to the entire system will soon be necessary.

Farm-to-Table is now at a point where its success may lead it to re-invent its processes. However, its commitment to its dual mission – to benefit the nutritionally at-risk members of the Central Vermont community by providing access to healthy local foods, while at the same time increasing the viability of local agriculture – remains as steadfast, as impassioned, and as necessary as ever.

CONTACT INFORMATION

Sara Lisniansky, Farm-to-Table Coordinator, Food Works at Two Rivers Center, 64 Main St., Montpelier, VT 05602, 802-279-6874, sara@tworiverscenter.org

PROJECT 11: Beginner Farmer and Apprentice Workshops in Commercial Organic Vegetable Production – Previously Accepted

PROJECT SUMMARY

Production and sales of locally grown vegetables and fruit are growing rapidly in Vermont; Vermont leads the nation in the consumption of locally produced foods and it is an important part of the economic activity in many Vermont communities. The number of new and aspiring organic vegetable and fruit farmers in Vermont has increased significantly to meet this demand, but many of these new farmers are first generation farmers and do not have farming backgrounds. These new farmers require up-to-date and reliable information in order to be successful. This project provides new farmers with opportunities to access relevant information and learn practical skills and techniques from recognized professionals and experienced growers in Vermont. Practical education helps attendees to be successful farmers and further the development of these economic growth trends in local vegetable and fruit production and sales.

PROJECT APPROACH

The Northeast Organic Farming Association of Vermont developed a series of eleven on-farm workshops for new and aspiring farmers on important production and business-related practices that occurred from July 14th to September 22nd in 2010. We used a modified CRAFT (Collaborative Regional Alliance for Farmer Training) model of farmers teaching farmers in regional locations for six workshops collaboratively developed with RAFFL, the Rutland Area Farm and Food Link. Five workshops were held in other locations around the state. Eight of these workshops were focused on topics important to beginning specialty crop farmers, free to growers, and funded by this grant. They are listed in the table below.

Although the Business Strategies session took place on a farm that made cheese the focus of the workshop was on the financial aspects of developing and running a business, which is a critical topic for specialty crop producers and diverse specialty crop farmers attending this workshop.

Our target number of workshops funded by this grant was seven; nine workshops were developed. Our target number of attendees was 40 to 60 farmers; we had well over that amount with 212 farmers and apprentices and 23 agricultural service providers attending.

The workshops provided attendees with up-to-date practical knowledge and information required for successful commercial organic specialty crop production and value-added enterprises. Participants highly evaluated the workshops, which had an overall rating of 4.53, when using a 1 to 5 scale with 5 being the best. Written evaluations by attendees at each workshop described new information learned and opportunities for its implementation, including: using spreadsheets for crop planning, cover cropping techniques, monitoring insects, relationship marketing, rotations, managing diseases, safety when working with equipment, and building a sustainable business. 100% of beginning and aspiring farmers surveyed requested that a similar series be held next year.

Our collaborative partner, India Burnett Farmer, Program Director for RAFFL, made a significant contribution to the organization of six workshops. RAFFL's farmer board of directors made a commitment to the project, their farms hosted workshops, they encouraged area beginning farmer and apprentices to attend, and RAFFL used its website to do local outreach for the series.

We conclude that the modified CRAFT model that has experienced farmers teaching new and aspiring farmers in a regional setting is a successful approach based on the farmer evaluations. We recommend and plan to continue this approach in other areas of the state next year.

Workshop Title, Host Farm and Location	Number of Farmers	Number of Ag Service Provider	Total Attending
A Community Supported Agriculture (CSA) Farm Tour at Luna Bleu Farm in South Royalton, VT	73	2	75
Building Soils: Soil Testing, Composting, Amendments at Dutchess Farm in Poultney, VT	33	5	38
Business Strategies at Blue Ledge Farm in Leicester, VT	16	3	19
Crop Planning: Succession Planting & Diversification at Cerridwen Farm in Poultney, VT	25	1	26
Farm Equipment Primer: Safety and Types of Equipment for Small Famers at Larson Farm in Wells, VT	17	1	18
Marketing Strategies for the Small Farm at Kilpatrick Family Farm in Granville, NY	10	3	13
Organic Pest and Disease Management at Boardman Hill Farm in West Rutland, VT	18	5	23
Tour of Dwight Miller Orchards and Diverse Organic Farm at Dwight Miller Orchards in East Dummerston, VT	20	3	23
Total Attending:	212	23	235

Individuals attending the workshops signed in when registering. We tracked that the farmers participating were all beginning specialty crop farmers (according to USDA's definition of beginner farmer). Although the majority of service providers who attended were not specialty crop farmers, they all serve specialty crop farmers through research or technical assistance.

In our first report submitted with our invoice, we indicated that there was some income raised by some of the workshops. 3 of the 11 workshops organized for beginning farmers had a fee associated with them, but they were not part of the Specialty Crop Block Grant targeted workshops.

As indicated above, 8 of the workshops for specialty crop growers were free and funded by this grant.

GOALS AND OUTCOMES ACHIEVED

Completed Activities:

During the winter of 2009 and 2010, collaborative partners were developed and workshop topics and content were developed. Expert presenters were identified for each workshop as well as host-farms.

Workshops were organized and outreach materials were developed in early spring of 2010. Publicity and outreach strategies were implemented. Workshop facilitator materials and evaluations tools were developed.

Workshops were conducted from July 14th through September 22nd of 2010. Workshop data and evaluations were collected. Publicity and outreach continued until the series was complete. In the fall, workshop evaluations were analyzed and summarized.

Achieving Outcomes:

Our target number of workshops funded by this grant was seven; nine workshops were developed. Our target number of attendees was 40 to 60 farmers; we had well over that amount with 212 farmers and apprentices attending and 23 agricultural service providers.

BENEFICIARIES

The direct beneficiaries were new organic and sustainable vegetable and fruit producers in Vermont.

Quantitative data pertaining to impacts of these workshops were not collected. Most survey questions were open ended, other than the numerical workshop evaluation. Anecdotally, the participating farmers noted the potential economic benefits from learning new business, production and marketing practices. As a result of attending the workshops, they feel they are better positioned in the marketplace.

LESSONS LEARNED

CRAFT programs were originally created by a community of growers with like minded commitments to the education of new farmers; experienced farmers both educated and mentored new farmers. The modified CRAFT model we developed and used for this program supports the education of new farmers by providing the organizational structure to allow expert farmers to be teachers. It was successful in part because of our regional collaborative partner whose farmer board provided a direct connection to the community of farmers in that region. These farmers were

willing to commit to the project, lend their expertise to educate specialty crop producers, and promote the series. We recommend and plan to continue the approach of working with a regional partner in other areas of the state.

Evaluations were lower in quantity than desired. We developed both paper and electronic evaluation formats. Paper evaluations could be either written in the field or taken home to be completed and later mailed to the NOFA-VT office. Electronic evaluations were available in Survey Monkey. The paper evaluations handed out in the workshop contained a link to the electronic evaluation. We received 12 paper evaluations and 12 electronic evaluations from participants. However, our collaborative partner conducted their own evaluation which had 16 responses, so we gleaned additional information from their survey. Next year we will use a simpler evaluation format to increase participation with check box options. We also plan to ask farmers how many new practices they learned so we can start to quantify the learning experience.

CONTACT INFORMATION

Wendy Sue Harper, Ph.D., Vegetable and Fruit Technical Assistance Advisor for NOFA-VT
Phone: 802-434-4122 x21 and email: wendysue@nofavt.org

ADDITIONAL INFORMATION

The beginner farmer workshops were marketed through a catalogue of summer workshop offerings; the whole catalogue can be viewed at <http://nofavt.org/sites/default/files/SWS2010.pdf>. Below is one section describing the beginner farmer workshops. Note that only some of the workshops (those targeted to specialty crop farmers) were part of this project.

Beginning Farmers & Apprentices

Workshops 1, 2, 5, 7, 8 & 9 are produced in partnership with the Rutland Food and Farm Link (RAFFL) and funded by a USDA Specialty Crop Block Grant; they are offered at no charge.

1 Wednesday, July 14 • 6:30 - 8:30pm Marketing Strategies for the Small Farm

Kilpatrick Family Farm • Granville, NY

Learn the basics of marketing - as they relate to your farm! We will give an overview of different marketing tools, emphasizing those which are a good fit for small farms. We'll cover our own marketing strategies, focusing on our extensive use of relationship marketing. Kilpatrick Family Farm grows a wide variety of Certified Naturally Grown vegetables, marketing them year 'round through farmers' markets and a CSA.

2 Wednesday, July 28 • 5 - 7pm Building Soils: Soil Testing, Composting,

Amendments

Dutchess Farm • Poultney

Farmer Stephen Chamberlain, NRCS Soil Conservationist Carla Fenner, and NOFA- VT Vegetable and Fruit Advisor Wendy Sue Harper will discuss the need to test soils annually, and how to use soil tests to

determine your need for organic fertilizers. We will demonstrate how a cover crop and vegetable rotation system can control weeds and increase organic matter without added manure or compost. We will discuss how to choose a site for vegetable production. Dutchess Farm grows 4 acres of produce using organic practices, selling to a 100-member CSA, the Rutland Farmer's Market, and the Rutland Co-op.

3 Saturday, July 31 • 1 - 4pm Introduction to Pasture Management: Using Ruminants to Improve Pasture

Bread and Butter Farm • Shelburne/S. Burlington \$10 for NOFA-VT and VGFA members, \$15 non-members

Livestock expert Sarah Flack will cover the fundamentals of setting up a new grazing system for ruminants - or improving an existing one. Using practical examples of grazing systems, we'll discuss pasture plant species and how to manage them for desirable plants, as well as how to do so with livestock and fence rather than expensive plowing and planting. Topics include plant species, grazing methods, fence, water systems, pasture design and layout, paddock size, and acreage. Cosponsored by the VT Grass Farmers Association.

4 Sunday, August 8 • 2 - 5pm

Beginning Farmers and Apprentices

Producing Eggs Year 'Round On Compost Without Purchased Grain & NOFAvore Social

Vermont Compost • Montpelier

\$10 for NOFA-VT members, \$15 non-members • Pre-registration requested for NOFAvore social

Vermont Compost Company was founded and supported by organic crop-growing professionals to meet the need for high quality composts and compost-based, living soil mixes for certified organic plant production. Integrated into this production is an innovative system that provides chickens with foraging opportunities to produce eggs along with compost. Come join us for an afternoon with Karl Hammer, founder of Vermont Compost, as he gives a tour of the farm and discusses the different enterprises that are intertwined. Following the workshop, there will be a community dinner with the NOFA pizza oven.

5 Wednesday, August 11 • 5 - 7pm Business Strategies and Cheese

Blue Ledge Farm, Leicester

Pre-registration required (limit 20)

Get a behind-the-scenes tour of Blue Ledge Farm as Greg Bernhart and Hannah Sessions extrapolate on what it takes to start and maintain a farmstead cheese operation. We will discuss equipment needs and costs for both the dairy and cheese production areas, value added ideas, and labor needs. They will "crunch the numbers" as to size and profit. Blue Ledge Farm was established in 2000 and now produces 40,000 pounds of artisanal cheese annually from the milk of their own 80 goats as well as two other area farms. Participants may purchase cheese after the workshop.

6 Tuesday, August 17 • 9am - 1pm Processing Chickens on the Farm All

Together Farm • Randolph

\$20 members, \$25 non-members • Preregistration required (limit 12)

Farmers Brad and Emily Johnson will go over the set-up, procedure, and safety of processing your own birds on the farm or at home. They will then lead the group step-by-step through the whole process. Participants can gain more experience by participating in the processing of a batch of their summer broilers. All Together Farm is a small-scale, diversified family farm raising animals on pasture.

7 1 Wednesday, August 25 • 5 - 7pm

Farm Equipment Primer: Safety and Types of Equipment for Small Farms with NOFAvore social and New Farmer Mixer!

Larson Farm • Wells

Pre-registration requested for NOFAvore social

Join Richard Larson as we go over basic safety rules for tractors and other typical small farm equipment.

We will talk about tractors, PTOs, tillage equipment, and bucket loaders. We will also talk about small equipment and, for livestock farmers, safety tips when working with animals. Time permitting, we can talk about preventative maintenance. Larson Farm is a former commodity dairy farm, now milking 20 Jerseys for raw milk and supplying a local artisan cheese maker, as well as raising grass-fed beef.

Plus! Join us for RAFFL's New Farmer Mixer and NOFAvore Celebration with the mobile pizza oven at 7pm! All new and aspiring farmers are invited to come mix, mingle, and meet new farming friends.

A sample of the survey distributed to participants in the courses is as follows:

NOFA-VT / RAFFL Workshop Evaluation

You have the option of completing this evaluation online at:

<http://www.surveymonkey.com/s/TQBWQLY>

Name of Workshop Attended (see list below):

I am a: Beginning Farmer (less than 10 years)

Farm Apprentice

Farm Worker

Intermediate or Advanced Farmer

Student

Ag Service Provider

Other _____

1. Rate each workshop you attended on a 1-5 scale. 5 is the best; 1 is the worst.

Marketing Strategies for the Small Farm, July 14th, Kilpatrick Family Farm, Granville, NY

Building Soils: Soil Testing, Composting, Amendments, July 28th, Dutchess Farm Poultney, VT

Business Strategies and Cheese, August 11th, Blue Ledge Farm, Leicester, VT

___ Farm Equipment Primer: Safety and Types of Equipment for Small Farms, Larson Farm, Wells, VT

___ New Farmer Mixer and NOFAvore Social

___ Crop planning: Succession Planting & Diversification Choices, Cerridwen Farm, Poultney, VT

___ Organic Pest and Disease Management, Boardman Hill Farm, West Rutland, VT

2. Please make some comments as to why you gave the workshop your ratings. What was great about it or how it

could be improved?

3. Do you expect to make use of the information you learned in these workshops? If so, what information will you use, and how will you use it?

4. What additional information would you like to have on any of these topics?

5. Please share with us topics for future beginning farmer and apprentice workshops. List workshop topics that are most important to you.

6. Did you attend the New Farmer Mixer and NOFAvore Social? If so, please tell us if we should have more of these tied to workshops and how important they are to you.

7. Would you have attended if we had scheduled a potluck meal before this workshop? How important is such an activity to your education and networking?

8. Please make any other comments that were not addressed above:

Please return this evaluation via mail to:

NOFA-VT

PO Box 697

Richmond, VT 05477

PROJECT 12: Exemplary food safety-related production and marketing practices for commercial organic vegetable and small fruit producers – Previously Accepted

PROJECT SUMMARY

All vegetable and fruit growers, both organic and conventional, can benefit from reliable, up-to-date information about agricultural practices that will enable them to improve the safety of their products. Also, growers with an interest in wholesale marketing of their farm products require information about food safety standards and food safety certification programs that are increasingly being required by wholesale buyers. The purpose of this project was to organize and offer two day-long workshops for commercial vegetable producers that would (1) present information about good agricultural practices associated with the safe production, handling and marketing fresh fruits and vegetables, (2) provide growers with an opportunity to learn about

USDA GAPs program standards, auditing protocols and certification requirements, and, (3) enable growers to evaluate food safety-related practices and USDA GAP certification opportunities on their farms.

Attention to good practices bearing on safe production, handling and marketing of fresh fruits and vegetables is of increasing importance to consumers, wholesale buyers and government regulators. A growing number of wholesale buyers are requiring vegetable producers with whom they do business to certify that they meet USDA-GAP standards for the production and handling of one or more crops. Producers' success in protecting and expanding their markets, both direct markets and wholesale markets, will increasingly depend upon demonstrated adherence to well-established food safety practices and protocols.

Note: Planners of this project concluded that the informational needs of conventional and organic commercial vegetable growers were sufficiently congruent that the workshops could, and should, be offered to all commercial growers. Workshops were publicized and promoted accordingly.

Earlier SCBG funding enabled us to organize and host two on-farm workshops that discussed and demonstrated food safety-related practices that had been adopted by farmer-hosts. One workshop was targeted to direct-market operations with attention given to farmer-initiated practices to improve the safety of produce grown and marketed directly to consumers on the farm. A second workshop, led by the farmer-host, highlighted one farm's efforts in gaining USDA GAPs Certification for produce marketed through wholesale channels.

Project work described in this report complimented the above by providing full-day, off-season workshops that enabled more growers to learn about good agricultural practices over a full-day program. These workshops enhanced the on-farm workshops held earlier by presenting and discussing food safety-related issues and practices in greater depth.

PROJECT APPROACH

A series of four planning discussions involving representatives of the Northeast Organic Farming Association of Vermont, the University of Vermont (UVM) Extension Service and the UVM Center for Sustainable Agriculture were held. During these discussions the scope and content of two day-long food safety workshops for commercial vegetable were developed; an experienced workshop presenter was identified and scheduled; workshop locations, dates and promotion plans were identified. Implementation was as follows:

USDA Good Agricultural Practices (GAPs) TRAINING FOR COMMERCIAL PRODUCE FARMERS

This full-day workshop was held in northern Vermont at Hampton Inn Conference Center in Colchester, Vermont on November 8, 2010 and in southern Vermont at the Fairfield Inn at White River Junction, Vermont on December 10. It was designed for commercial growers interested in how the USDA GAP program works and what is included in an audit. Those interested in becoming GAP (Good Agricultural Practices) certified for wholesale markets were guided in evaluating their

facilities and practices to prepare for a GAPs audit. Representatives of wholesale buyer companies and service provider organizations were welcome to attend.

A morning presentation included information about pathogens associated with fresh produce, strategies for reducing food safety risks in all steps of production, and how to meet the requirements of a USDA GAPs Audit. The afternoon session enabled attendees to develop a draft of a food safety plan for their farm. Growers could attend the morning session or both morning and afternoon sessions. All attendees received a manual filled with GAP resources, a CD loaded with customizable templates needed to maintain USDA GAP records. Additional food safety-related information and brochures were available.

The workshop instructor was Rich Bonanno, Ph.D., UMass Extension Educator with UMass GAP project, Extension Educator with UMass Extension and co-Principal Investigator on the UMass GAP project.

Additional instructional support was provided by Vern Grubinger, UVM Extension Vegetable Specialist; Steve Parise, GAPs auditor, Vermont Agency of Agriculture, Food and Markets; Ginger Nickerson, GAPs Coordinator, UVM Center for Sustainable Agriculture; Hans Estrin, Local Food Network Coordinator, UVM Extension, and David L. Rogers, Policy Advisor, Northeast Organic Farming Association of Vermont.

Total attendance (both days): 61 attendees (40 commercial vegetable growers, 8 service providers, 2 wholesale buyer representatives, 11 workshop instructors & host affiliates)

Outcomes: (1) Evaluation forms completed by workshop participants indicated that the workshops were well-received by all attendees. All commercial farmers who completed evaluations (n=25) agreed or strongly agreed with statements that asked if the workshop information was well-presented and understandable and that it would be of value on their farms in improving practices, (2) All commercial growers who completed evaluations indicated that they had attended the workshop because a buyer was requiring new GAP certification or that they thought GAP certification or food safety plans for their farm might be required in the future, (3) an important outcome was a verbal recognition by a number of grower-participants in each workshop that the development and adoption of food safety practices was increasingly important for all farms, and that implementation of these practices on their farms could, in many cases, be less onerous and expensive than they had previously thought, .

These workshops were collaboratively organized, facilitated and publicized by Vern Grubinger, UVM Extension Vegetable Specialist; Steve Parise, VAAFM GAPs auditor; Ginger Nickerson, UVM Center for Sustainable Agriculture, GAPs Outreach Coordinator; David Rogers, Policy Advisor, Northeast Organic Farming Association of Vermont ; Steve Justis, Vermont Tree Fruit Growers Association; Hans Estrin, UVM Extension Local Food Network Coordinator.

GOALS AND OUTCOMES ACHIEVED

Inclusion of long-term outcome measures were not applicable for this project, but, based on growers' evaluations and comments, long term outcomes are likely. Growers will apply information and insights gained through their participation in the workshops in developing and adopting improved food safety practices on their farms.

The structure and content of these workshops matched the stated goals of the project closely by providing commercial growers with information pertaining to exemplary food safety-related techniques and practices bearing on the production, harvesting, handling and marketing of fresh fruits and vegetables. These attendees were provided with important information and practical advice about USDA GAPs standards and auditing procedures that will enable them to improve food safety practices and wholesale marketing opportunities in the future. Attendance by commercial growers was good – 20 farmers attended each of the workshops.

BENEFICIARIES

Commercial fruit, apple and vegetable growers in Vermont (conventional and organic) were the primary beneficiaries. Agricultural service providers who attended represented a USDA organic certifying agency (Vermont Organic Farmers, LLC) and the University of Vermont Extension Service.

The nature of this project was such that quantitative data pertaining to its potential impacts was not available. However, growers' comments and evaluations indicated that the workshops furthered their understanding of good agricultural practices that can contribute to the safe production and handling of their farm products, thereby they will be better positioned in the future to protect and expand their direct and wholesale markets.

LESSONS LEARNED

While attendance by commercial growers at these workshops was good and they were highly rated by attendees, the workshop's content and focus on USDA GAPs was, we believe, not viewed as highly relevant by a large number of commercial growers who direct market their products or sell them wholesale to local buyers who are not likely to require USDA GAPs certification in the future. There is an important need and opportunity to develop food safety workshops and short courses that appeal to these growers and that provide comprehensive and practical information and ideas for improving food safety-related practices.

CONTACT INFORMATION

Enid Wonnacott, Executive Director, NOFA Vermont
802-434-4122; enid@nofavt.org

ADDITIONAL INFORMATION

From the Workshop Brochure:

USDA Good Agricultural Practices (GAPs) TRAINING FOR COMMERCIAL PRODUCE FARMERS

Recent outbreaks of food borne illnesses in fruits and vegetables have brought food safety on produce farms to the forefront of consumer consciousness. In response, some chain supermarkets and other buyers are requiring farms undergo a USDA Good Agricultural Practices (GAPs) Audit to certify that they are following food safety practices. This workshop is for commercial growers who want to learn more about how the USDA GAP program works and what is included in an audit. If you are interested in becoming GAP (Good Agricultural Practices) certified for wholesale markets, it will help you evaluate your facilities and practices to prepare for a GAPs audit.

Attendees to the morning session will learn about pathogens associated with fresh produce, strategies for reducing food safety risks in all steps of production, and how to meet the requirements of a USDA GAPs Audit.

Attendees to the afternoon session will leave with a draft of a food safety plan for their farm. Growers can attend just the morning session or both the morning session and the afternoon session depending on their needs.

All attendees will receive:

- ☑ A manual filled with GAP resources
- ☑ A CD loaded with templates needed to maintain USDA GAP records that you can tailor for your operation

8:30 – 12:00 Morning Session

- ☑ Overview of food borne-pathogens and food safety issues
- ☑ Overview of pending federal regulations, marketing trends and future prospects in food safety
- ☑ Review of the most common on-farm food safety challenges and best practices
- ☑ Review of the GAP Audit Checklist

12:00 – 1:00 Lunch (provided)

1:00 – 4:00 Afternoon Session:

- ☑ Working from a template, growers will draft a farm food safety plan tailored for their operation.
- ☑ The Vermont GAPs Auditor and Extension educators will be available to answer questions.
- ☑ Growers attending the afternoon session will be asked to fill out a one-page evaluation of your operation prior to the workshop to make the most efficient use of your time.

Instructor: Rich Bonanno, Ph.D., UMass Extension Educator with UMass GAP project. Rich Bonanno is an Extension Educator with UMass Extension and is a co-Principal Investigator on the UMass GAP

project. He is also responsible for weed management in vegetable and small fruit crops. Rich currently serves as president of the Massachusetts Farm Bureau Federation and is a past-president of the New England Vegetable & Berry Grower's Association. Rich owns and operates Pleasant Valley Gardens in Methuen, MA, where he raises vegetables and flowers on 50 acres.

Additional service providers will be on hand to answer questions: Vern Grubinger, Ph.D., UVM Extension and Vermont Vegetable and Berry Growers; **Dave Rogers**, Northeast Organic Farming Association-Vermont Policy Advisor; **Ginger Nickerson**, UVM Extension Center for Sustainable Agriculture GAPs Outreach Coordinator; **Hans Estrin**, UVM Extension Local Food Network Coordinator; **Steve Justis**, Vermont Tree Fruit Growers Association. **Steve Parise**, VT Agency of Agriculture USDA GAPs Auditor, will be on hand to help answer questions.

PROJECT 13: Product Testing of Lightly Processed Vermont Vegetables for the School and Institutional Market – Previously Accepted

PROJECT SUMMARY

The goal of this project was to assess the feasibility and create a model plan for lightly processing and marketing Vermont-grown fruits and vegetables to Vermont schools. Six independent Vermont producer members of Deep Root Cooperative, Inc. (DRC) involved in this project market 99% of their products out-of-state due to a lack of well-developed, in-state wholesale markets. While Vermont public schools spend \$2.1 million annually on fruits and vegetables, only \$90,000, or less than 5% of this total is spent locally. The Northeast Organic Farming Association of Vermont (NOFA-VT) applied for a Value-Added Producer Grant on behalf of six independent producers of Deep Root Cooperative. The goal was to expand the potential for efficient use of Deep Root product, grow sales for Deep Root farmer/members, meet the Vermont-grown product demand of these institutions, and take advantage of the increasing interest of locally grown and consumed products. They are interested in keeping more of their products in Vermont, but do not yet work with the schools, nor know what products schools would use. As a partner in Vermont Food Education Every Day (VT FEED), a statewide farm to school project, NOFA-VT's role for eight years has been working with schools on local purchasing and, therefore, understands this market extremely well. In addition, over 100 schools already purchasing local raw and whole fruits and vegetables, reported in 2007 that they are interested in 'ready-to-use' processed fruits and vegetables.

In order to develop several minimally processed products to test in a number of schools and a hospital to get more thorough and meaningful results, we needed to purchase thousands more dollars of produce than originally planned. This SCBG gave us the opportunity to purchase additional produce to process and test.

PROJECT APPROACH

The intended outcome of the project was to help the producers move beyond fall and spring fresh sales of raw and whole fruits and vegetables and to develop a consolidated system to process, store,

and distribute Vermont-grown products to Vermont schools throughout the year. Working with the producers, processors, and school food service personnel this study will help to identify the financial feasibility, the best raw products, processing methods and distribution channels to provide value-added products that can be used by the school market. Fruits and vegetables in this form would expand the six independent Vermont producers' existing customer base, significantly increase the number of units available for sale and accrue incremental revenue to the independent producers.

The three most important factors in determining feasibility were:

- 1) Students will eat it
- 2) Food service likes working with the product
- 3) The price point of the processed product is affordable to school meal programs (relative to their saved labor time and the price of alternative product choices)

1. Abbie Nelson and Jean Hamilton, the Project Coordinator formed an advisory group of the participating six independent Vermont producers, processors, VT Agency of Agriculture, Department of Education Child Nutrition Program, and school food service directors about what raw fruits and vegetables would be suitable for processing and in what form, to create value-added products (including pack size, quantity, packaging, etc.).

2. Chris Poshpeck, manager of Deep Root Cooperative, which the six independent producers belong to, consolidated the raw products and coordinated delivery of the produce to a centralized processing facility (Vermont Food Venture Center). Deep Root also arranged with local distributors for delivery to the schools.

4. Brian Norder, Director of the Vermont Food Venture Center and NOFA-VT staff processed the produce in test batches to determine the best methods and form for producing value added fruits and vegetables.

5. Abbie Nelson and Jean Hamilton of NOFA-VT coordinated the sampling of the value added products at eighteen Vermont schools and surveyed the end users about the acceptability of the products.

6. Brian Norder of the Vermont Food Venture Center did the production and cost analysis of the four products.

7. Abbie Nelson of NOFA-VT conducted a meeting with the advisory group of farmers, processors, school food service directors, VT Agency of Food and Markets, and the VT Child Nutrition Program to analyze the results of the product samplings (including pack size, quantity, packaging, etc.).

8. Abbie Nelson and Jean Hamilton worked with the Vermont Food Venture Center to produce a Feasibility Report assessing potential production methods, processing and distribution costs, and

potential success of marketing value-added, 'ready-to-use' fruits and vegetables to Vermont schools.

9. Steve Paddock of the Vermont Small Business Development Center produced a model Enterprise Business Plan that provides comprehensive details on the management, planning, and other operational aspects of processing and marketing the, 'ready-to-use' fruits and vegetables to Vermont schools.

10. Abbie Nelson, along with a representative from the VT Agency of Food and Markets developed a preliminary survey of other marketing channels to support the value-added products (hospitals and other institutions).

11. Steve Paddock of the Vermont Small Business Development Center developed a Marketing Plan model for Vermont-grown value-added fruits or vegetables to Vermont schools, including the identification of a market window, the identification of potential buyers, a description of the distribution system, and possible promotional campaigns.

GOALS AND OUTCOMES ACHIEVED

The goal of this project was to assess the feasibility of the Vermont Independent Producers in the Deep Root Organic Truck Farmers Cooperative, Inc. to process and market 'ready-to-use' Vermont-grown fruits or vegetables to Vermont schools.

Goals/Activities in Grant	Accomplishments
<p>Conduct a Feasibility Study for the proposed value-added venture to help determine the potential marketing success of the venture.</p>	<p>Developed and tested four minimally-processed products grown by Deep Root Organic Coop Farmers, including: Frozen potato wedges, frozen mashed squash, frozen diced potatoes, and frozen Vermont summer vegetable medley and tested these at 15 schools Elem, MS, HS. The original grant called for testing in 20 schools, however, Deep Root farmers had not grown vegetables specifically for this grant since we did not receive the grant until Sept. Thus, they did not have enough potatoes or squash in storage. For the Summer Vegetable Medley, farmers could not afford to divert more produce to serve the original 20 schools and therefore tested in 15 sites instead.</p>
	<p>Determined that all of the products were favorably received by school food service staff and student end-users. Staff and students preferred the fresher and more robust flavor of these products. However, we also identified a number of challenges in processing, packaging, and delivering these products, which would</p>

	need to be explored in further product development.
	Developed a Feasibility Study for processing and marketing frozen berries in two forms grown by Deep Root Organic Coop Farmers. This study offers the breakdown of costs of processing Vermont-grown, organic berries and a foundation for developing a more comprehensive product development plan in the future.
	Convening the steering group of farmers and food service directors was one of the greatest strengths of this project. As more and more food service programs seek to serve locally sourced products in their schools and more farmers seek to market to local institutions, this steering committee provided direct communication between these two parties. The collective effort to find products that would work well for all stakeholders provided an excellent launching pad for this feasibility study and a solid foundation for further exploration.
Business Plan for the Deep Root Organic Truck Farmers Cooperative, Inc. that provides comprehensive details on the management, planning, and other operational aspects of processing and marketing value-added fruits or vegetables to Vermont schools	The Feasibility Study and Enterprise Business Plan of this project determined that more product development and market research would be necessary for Deep Root Coop to take on the risks developing a minimally-processed product line for the school food service market.
Develop a Marketing Plan for Deep Root's value-added fruits or vegetables, including the identification of a market window, the identification of potential buyers, a description of the distribution system, and possible promotional campaigns.	The Feasibility Study and Enterprise Business Plan recommended that further market study and product development is necessary before Deep Root Coop assumes the risk and expenses associated with developing a marketing plan for these products.

BENEFICIARIES

- 1) Deep Root (as described in the summary) could benefit it's farmer members by expanding into a new marketing channel and therefore sell more of their products in state, rather than trucking it out of state. In addition, if the market is viable, minimally processed product brings a higher return than selling whole product.
- 2) School Food Service programs could offer Vermont produce more months of the year and can support VT farmers.

- 3) We only tried a small quantity of product with the hospital, Fletcher Allen Health Care, but the product was well received. Providing minimally processed produce to hospitals as well will increase the demand and, therefore, the market share in VT for Deep Root and other farmers.

LESSONS LEARNED

1. Convening the steering group of farmers and food service directors was one of the greatest strengths of this project. As more and more food service programs seek to serve locally sourced products in their schools and more farmers seek to market to local institutions, this steering committee provided direct communication between these two parties. The collective effort to find products that would work well for all stakeholders provided an excellent launching pad for this feasibility study and a solid foundation for further exploration.
2. Because the “Feasibility Study for Processing and Marketing Vermont-Grown Fruits and Vegetables for Vermont Schools” project intended to explore new market opportunities, we were not surprised to encounter challenges every step of the way. One of the biggest challenges, the crux of this study, was to identify minimally processed products that satisfied the three primary stakeholders involved in this marketing relationship: the farmers, the school food service staff, and the product end-users (the students). Each stakeholder represented steadfast needs, which offered small margins of opportunity for finding mutually satisfactory products. The difficult nature of finding a product that students would readily accept, that food service programs could afford to purchase, and that farmers could afford to produce is reflected in the Feasibility Study and Enterprise Business. Despite this challenge, the conversations that this project initiated between the Deep Root farmers and school food service have laid a solid foundation for further exploration both for the schools and for the Deep Root Coop.
3. Another challenge of this project was developing the temporary labor force and processing facility to test the feasibility of the production. Especially with the case of the potato wedges, it was difficult to generate an accurate understanding of what the true labor time would be because our project relied on significantly scaled down equipment to process the potatoes. The appropriate processing tool, a Urschel Wedger, was far too costly to procure for use in a feasibility study, but would have dramatically reduced the labor time (and cost) involved with making the potato wedges. Similarly, some of the packaging used in the feasibility study was not a true reflection of what would be used in a true-marketed product. For example, in some cases the distribution boxes did not hold up well to the rigors of delivery and storage. In these instances, school food service staff found the products to be less favorable. It is likely that a sturdier box would be used if the products were to be fully developed.

In future processing feasibility studies, we will include a range of institutions beyond the school food service market. While the primary goal of this feasibility study was the school food service market, we learned that integrating other institutional buyers such as hospital food service and college/university dining facilities could help broaden the end-point price margins. These different

institutions have very similar needs for food products, although their target price points are slightly higher than those of the school market. This balance of similar demand and diversified price margins could represent the right market balance to make a minimally-processed, locally-grown product line feasible in Vermont.

Working with a number of school food service directors was critical to the success of this project. It was very important to see how different directors and staff used the products because each school's food service program tended to have such different cooking styles and preferences. It was also important that the directors who participated in this study had a basic commitment to and experience with using local and whole ingredients so that they were able to compare these products to others they have used recently. In a second phase of this study, we would likely introduce the products to less experienced food service staff to test viability.

In the future, we would like to include a number of experienced food processing entrepreneurs in the advisory group, as we feel their experience with the marketplace could help guide product development with recent successful trends, innovations, and available resources. While the Food Venture Center was a critical partner in product design, the steering committee could have benefited from the guidance of food processors who are actively marketing products to the target stakeholders (in this case school food service).

CONTACT INFORMATION

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PROJECT 14: Regional Local Foods Directories – Previously Accepted

PROJECT SUMMARY

The Regional Local Foods Directories project provided small grants to regional organizations to develop directories for connecting consumers with specialty crop producers interested in accessing a local market. In order to be eligible, organizations had to match the Specialty Crop Block Grant funding for this program funds to cover the portions of the guide that address foods outside of specialty crops.

PROJECT APPROACH

Three communities received funds to create Local Foods Directories.

- 1) Valley Farm and Food received \$1,000 to publish the Valley Farm and Food Guide. The Guide is searchable online, and is also available in print. The online version can be viewed here: <http://www.vitalcommunities.org/agriculture/onlineguide/index.cfm>.
- 2) South Hero Land Trust received \$1000 to publish an updated edition of the “Champlain Islands Grown” Guide to Agriculture.

- 3) Bennington County Conservation District received \$800 to update their www.benningtonlocal.org website. Thus far they have sent out surveys to 187 producers to solicit up-to-date information. This information is being now compiled and updated to the website.

GOALS AND OUTCOMES ACHIEVED

All grants went to regions where there was an existing directory that needed updating. Outcomes are as follows:

- Forty-five distinct farmers were listed in the Champlain Islands Grown Guide to Local Agriculture, a 25% increase over the 2008 guide.
- The number of producers profiled on www.benningtonlocal.org has been increased two-fold, to sixty-one producers.
- Over 200 specialty crop producers are now listed on the online Valley Farm and Food Guide, more than double the number that were listed in the print guide.

BENEFICIARIES

The primary beneficiaries are the producers who are listed in the guides. Surveys of growers conducted by the regional groups found that farmers felt that these guides were successful in driving new customers to their businesses.

LESSONS LEARNED

Staff turnover at the Agency of Agriculture left us with decreased capacity to play a coordinating role in the development and evaluation of these guides. We have invested a greater amount of staff time in the Vermont Ag and Culinary Tourism Council, which is developing a website that will drive culinary experiences on farms, and hope that this website might streamline and centralize information that was previously provided in regional publications and the Vermont Harvest print guide.

CONTACT INFORMATION

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PROJECT 15: Assessment of Marketing Impacts – Previously Accepted

PROJECT SUMMARY

Over the years, significant funds have been invested in paper publications to market specialty crops. VAAFM was interested in evaluating the usefulness of these publications, and determining where people get their information on specialty crops. UVM was contracted to place three questions in the 2010 Vermonter Poll about local food.

PROJECT APPROACH

We wrestled with how to pose the question such that the results would solely enhance the competitiveness of specialty crops. In the end, however, we felt that the average consumer would not understand what was meant by the term “specialty crop” if it was used in a question. We thought about asking about “fruits and vegetables,” but did not want to exclude maple syrup, honey, hops, or wine grapes. In the end, we thought that we would get the best results for specialty crop producers if we posed the questions about “local food” in general. The results of the survey were not shared with non-specialty crop producers.

VAAFM also partnered with UVM student Tracy McCowen on a comprehensive survey of farmers. McCowen created a written survey to determine specialty crop producers’ use of, and interest in, different media to advertise their products, managed distribution and data collection for the survey, and summarized responses in a written report.

GOALS AND OUTCOMES ACHIEVED

We discovered that most Vermonters get information about local foods from word of mouth (30%), followed by print advertisements in the newspaper such as the Vermont Harvest publication (27.45). Nearly half of all respondents stated that local food was more expensive than non-local. The biggest obstacles keeping Vermonters from buying more local foods were availability (32.2%) and price (29.5%).

263 farmers responded to McCowen’s survey. Word of mouth was reported to be the most effective form of marketing. TV commercials were found to be the least useful. In terms of print media, 69% found it to be useful, 22% found it to be not useful, and 9% were unsure.

Due to the spread of Food Hubs and other sub-regional marketing groups, over 80% of producers in the state are covered by at least one group that is connecting specialty crop producers with consumers. In addition, a number of online platforms have emerged, bringing coverage to nearly 100%. Although we do not have data on the percent of direct marketing producers who take advantage of these services, we estimate that 100% of producers could be listed if they chose to.

BENEFICIARIES

This report will form the basis of a report on agricultural marketing which will be posted on the Specialty Crops section of our website and distributed through the Farm to Plate Network to inform the work plan of the Consumer Education and Marketing Working Group. It will also be integral to the development of the new Vermont Branding Program. Ultimately, the beneficiaries will be all Vermont Specialty Crop Producers

LESSONS LEARNED

We learned that word of mouth is the most powerful form of communication about local foods. This underscores the importance of building communications networks and strengthening our regional food hubs.

CONTACT INFORMATION

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PROJECT 16: Effectiveness of Triple Washing or Organic Sanitizer Treatment in Reducing E.coli Levels in Leafy Green Wash Water and its Relationship to Incoming E. coli load

PROJECT SUMMARY

Vermont vegetable growers are interested in practical techniques for reducing food safety risks. E. coli, a species of bacteria containing many strains found in the mammalian gastrointestinal tract, may be present in farm soils as a result of animal manure applications, irrigation with surface water, and/or wildlife activity. Currently, little is known about the level of E. coli and other bacteria in vegetable wash water or the effectiveness of triple washing in reducing those levels. Reducing levels of bacteria in wash water is one way to reduce food safety risks, specifically the risk of cross-contamination whereby one contaminated item leads to the spread of bacteria to other items being washed in the same water.

PROJECT APPROACH

Activities and Tasks Performed (Methods):

Wash Water Study Farm Site Selection

Three certified organic Vermont vegetable farms representing different scales of production and geographic location were selected for the study. All farms used composted manure on their soils within the last year to improve soil fertility, and all farms had an un-chlorinated but potable water supply for washing vegetables. Participating farms used different washing methods, as dictated by their infrastructure and markets. Samples were collected approximately weekly from June – September, 2012 (sampling time frame varied by farm) by UVM Extension personnel.

Sanitizer

SaniDate® 5.0, BiosafeSystems, LLC, is a sanitizer/ disinfectant containing the active ingredients hydrogen peroxide (23%) and peroxy acetic acid (5.3%) which is OMRI-labeled and thus acceptable for use on organic farms. SaniDate® 5.0 is labeled for post-harvest use of fruit and vegetable processing water at a rate of 0.5oz (15 ml) / 10 gallons (38 L) water, a 1:1000 dilution.

Washing and Water Sample Collection

Farm 1 – Heads of lettuce, leafy greens and other vegetables were washed by gentle agitation for 5-10 seconds per bay in a triple bay stainless steel sink with each bay containing 10 gallons of water without sanitizer. Wash water samples were collected from each bin. A full dose of SaniDate® 5.0

(15 ml) was then added to the first bin and a half-rate of SaniDate® 5.0 (7.5 ml) was added to the second bin (the addition of half-rate SaniDate® 5.0 to the second bin was limited to samples taken towards the end of the study period). Wash water samples were then collected promptly after gentle mixing from the first and second bin following the addition of SaniDate® 5.0. At the end of the washing and sampling, all three bays were emptied, thoroughly rinsed with potable water and refilled for the next batch of produce.

Farm 2 – Leafy green salad mixes were triple washed in 150 gallon tubs containing approximately 135 gallons of potable water without sanitizer. Typically one batch contained two to four harvest bins of salad greens, each weighing approximately 30 lbs. After each batch the water from the first wash was drained and refilled with fresh water. For the next batch of greens, the wash tub that had been used for the second wash was used for the first wash, the wash tub that had been used for the third wash was used for the second wash, and the newly filled tub (previously the first wash but now with fresh water) became the third and final wash. The goal of the tub rotation is to conserve water (only one tub is changed out per batch instead of three) without compromising water quality, particularly in the final wash. Wash water samples were collected at the end of a batch from each tub. Ten gallons was removed from tub one into a 12-gallon tote. To the sample ten gallons, a half rate of SaniDate® 5.0 (7.5ml) was added, stirred, and a water sample was collected. An additional 7.5ml SaniDate® 5.0 was then added to achieve a full dose, stirred, and a wash water sample was again collected.



Photo 1 - Triple wash system for salad greens at Farm 2. Gray harvest containers (right in photo) contain salad greens from the field. Three stock tanks are used to triple wash greens. Greens are moved from tank to tank inside of a net with pulley. Greens are then moved to a sloping board to drain and spun dry in the spin cycle of a washing machine. Greens are bagged and sold directly to restaurants and institutions.

Farm 3 – Mixed produce was triple washed in 100 gallon tubs containing approximately 85 gallons of water without sanitizer. Produce varied weekly depending on the harvest and wash water was not changed in between produce types. After washing, wash water samples were collected from each bin. A full dose of SaniDate® 5.0 (120 ml) was then added to the first bin and a half-rate of SaniDate® 5.0 (60 ml) was added to the second bin. Wash water samples were again collected from the first and second bin following the addition of SaniDate® 5.0.

Intentional Contamination

In order obtain wash water samples with sufficiently high *E. coli* levels needed to overwhelm triple washing and the addition of sanitizer, initial wash water was intentionally contaminated with llama manure at a third site as follows:

Phase 1: Goat and llama manure in natural (pellet) and slurry form were mixed into 10 gallons of water to determine baseline levels in what would be equivalent to the first wash. After 5 minutes, water samples were taken.

Phase 2: Using the manure load from Phase 1 as a guide, manure was added to the first wash of a triple wash system set up to wash 8 lbs of leafy green (kale or Swiss chard) in 10 gallons of water. Samples were collected from:

- each of the triple wash totes without sanitizer (n=3)
- first wash with a half rate of sanitizer
- first wash with a full rate of sanitizer
- second wash with a half rate of sanitizer

Laboratory Analysis

Water samples were tested for *E. coli* (MPN CFU /100ml) by the Vermont Department of Health Laboratory using an Enzyme Substrate Test (EST)-Quantitation from IDEXX. When counts were expected to be high (i.e., the first wash), a portion of the sample was set aside to use for dilution (1:100), if necessary. Results are reported as Most Probable Number (MPN) / 100ml.

Data Analysis

Data were entered and analyzed using Microsoft Excel 2010. The range of *E. coli* levels in the initial untreated wash water from the three farms were used to reflect the natural range of incoming levels of *E. coli* on produce. Reduction of *E. coli* levels with each additional wash and following the addition of SaniDate® 5.0 in half and full concentrations to the first wash and/or half concentrations to the second wash were calculated both as log₁₀ and percent reductions. An artificial value of 0.5 MPN / 100ml was inserted for zero values for the purposes of calculating log₁₀ reductions. Percent reduction means were compared using a two-tailed paired t-test when comparing washes and treatments from the same sample sets (e.g., double vs. triple washing). Percent reduction means were compared using a two-tailed Student's t-test when comparing different wash types (e.g., greens vs. non-greens washes) or different sites. Groups were tested for equal variances using the f-test to determine the type of Student's t-test used.

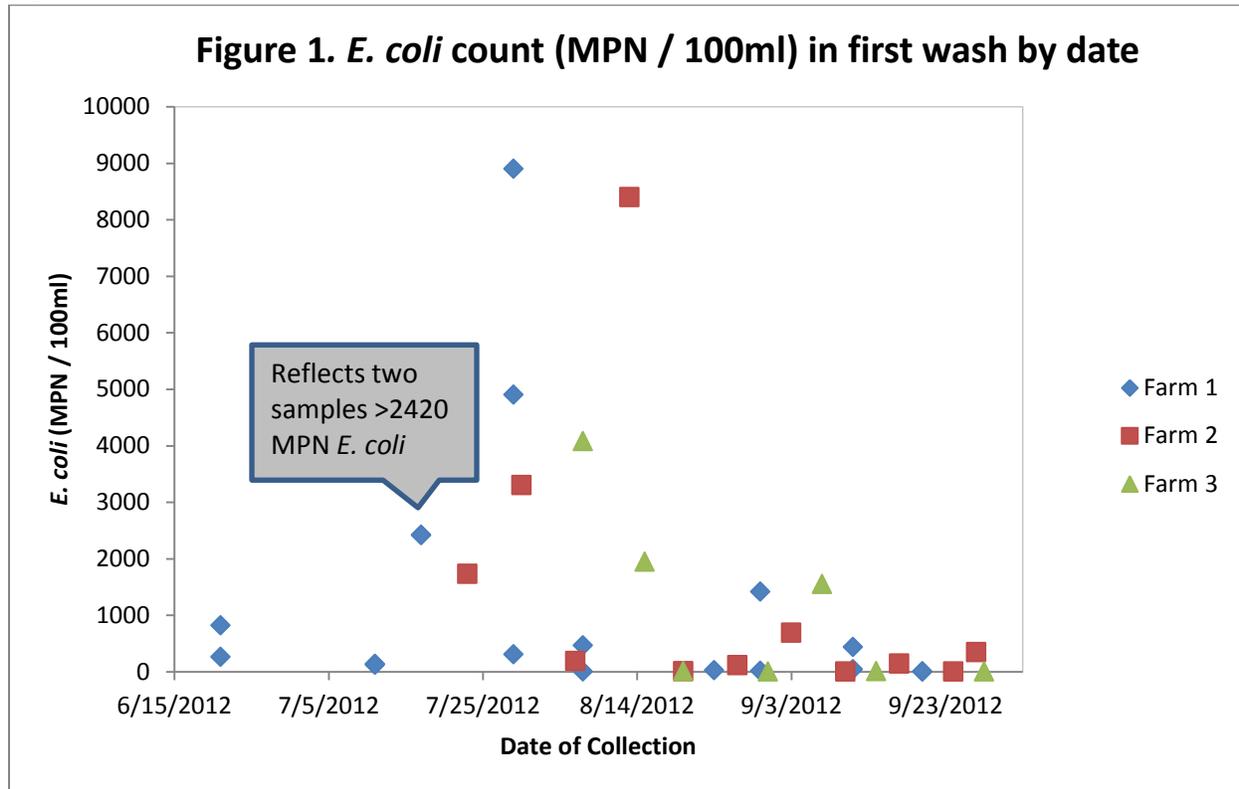
Results:

Farm Sites

A total of 36 sets of wash water samples were collected: eighteen from Farm 1, eleven from Farm 2, and seven from Farm 3. Two of the first washes were not diluted and had results reported as >2420 MPN / 100ml *E. coli*, indicating *E. coli* levels that exceeded the upper limit of detection of the test without dilution.

E. coli levels in the initial wash varied widely from 0-8900 MPN / 100ml. High levels were observed at all farms and for a variety of produce types in late July to early August. *E. coli* levels were consistently lower in late August and early September (see Figure 1). Although we did not systematically collect data on weather conditions and the appearance of the wash water, levels of *E. coli* did not appear to be affected by these variables.

Figure 1.



Of the 36 sample sets, 13 were excluded from reduction analysis due to *E. coli* counts <50 MPN / 100ml in the first wash. Including these sets in the analysis would have increased the rates of reduction since subsequent washes typically yielded 0 counts (resulting in low actual but high percent (typically 100%) reduction). Two additional sets were excluded from analysis because the initial reading was reported as >2420 MPN, the limit of detection of the test without dilution. An accurate result for the first wash is necessary for accurate percent and log₁₀ reduction calculations. Thus, twenty-one sample sets were used for on-farm reduction analysis.

The mean reduction of *E. coli* in the single wash with a full dose of sanitizer was 99.8%, which outperformed all other washes and treatment ($p < .01$). Triple washing produced significantly greater reductions than double washing ($p < .01$) or single washing with a half dose of sanitizer (Farm 2 only, $p = .03$).

On average, the second wash reduced *E. coli* levels by 87.9%. The second wash reduction was higher (90.9%) for greens only than for non-greens (78.5%) but there was no significant difference between greens and non-greens produce types for any of washes or treatments due, at least in part,

to the small sample size (n=5) of non-greens produce. Double washing with a half dose of sanitizer appeared to perform well (98.3% reduction), although this sample size (n=5) limited statistical comparisons with other treatments. A single wash with a half dose of sanitizer did not perform as well as a single wash with the full dose, 90.8% vs. 99.8% reduction, respectively (p=.01), suggesting that the full dose recommendation is necessary for maximum effectiveness in the case of a high level of contamination. Tables 1 and 2 display percent and log10 reductions, respectively.

Table 1. Mean and (range) Percent Reduction of <i>E. coli</i> by Wash and/or Treatment					
Farm / Produce Type	Double Wash	Triple Wash	Double Wash + Half-rate SaniDate® 5.0 *	Single Wash + Half-rate SaniDate® 5.0 **	Single Wash + Full-rate SaniDate® 5.0
Farm 1 n=10*	88.54 (51.7 - 98.2)	97.9 (94.9 - 100)	98.7 (96.3 - 99.9)	--	99.9 (99.2 - 100)
Farm 1 Greens Only n=7	93.8 (80.2 - 98.7)	98.1 (94.9 - 100)	98.7 (96.3 - 99.9)	--	100 (99.9 - 100)
Farm 1 Non-Greens n=3	76.2 (51.7 - 99.2)	97.2 (96.4 - 98.1)	--	--	99.7 (99.2 - 100)
Farm 2 n=8	88.0 (73.9 - 98.8)	97.0 (89.6 - 99.6)	--	90.8 (79.9 - 99.8)	100 (100 - 100)
Farm 3 n=3	85.9 (74.3 - 94.1)	93.4 (88.0 - 97.0)	97.7 (96.9 - 99.4)	--	99.0 (96.9 - 100)
All Farms All Produce Types n=21	87.9 (51.7 - 98.8)	96.9 (88.0 - 100)	98.3 (96.3 - 99.9)	90.8 (79.9 - 99.8)	99.8 (96.9 - 100)
All Farms Greens Only n=16	90.9 (73.9 - 98.8)	97.5 (94.9 - 100)	98.7 (96.3 - 99.9)	90.8 (79.9 - 99.8)	99.8 (96.9-100)
All Farms Non-greens N=5	78.5 (51.7 - 99.3)	95.0 (88.0 - 98.1)	97.7 (96.0 - 99.4)	--	99.8 (99.2 - 100)

*n=3 for Farm 1, Farm 1 Greens Only, and All Farms Greens Only. n=2 for Farm 3. n=5 for All Farms All Produce Types.

**n=8 for Farm 2, All farms All Produce Types, and All Farms Greens Only.

Figure 2. Mean and (range) Log10 Reduction <i>E. coli</i> by Wash and/or Treatment					
Farm / Produce Type	Double Wash	Triple Wash	Double Wash + Half-rate SaniDate® 5.0 *	Single Wash + Half-rate SaniDate® 5.0 **	Single Wash + Full-rate SaniDate® 5.0

Farm 1 n=10*	1.28 (0.32 - 2.14)	1.93 (1.30 - 3.38)	2.42 (1.43 - 3.15)	--	3.82 (2.12 - 5.25)
Farm 1 Greens Only n=7	1.38 (0.70 - 1.89)	2.09 (1.30 - 3.38)	2.42 (1.43 - 3.15)	--	3.92 (2.91 - 4.99)
Farm 1 Non-greens n=3	1.03 (0.32 - 2.14)	1.57 (1.44 - 1,72)	--	--	3.60 (2.12 - 5.25)
Farm 2 n=8	1.09 (0.58 - 1.93)	1.69 (0.98 - 2.37)	--	1.35 (0.70 - 2.64)	3.12 (2.32 - 4.23)
Farm 3 n=3	0.93 (0.59, 1.23)	1.26 (0.92 - 1.53)	1.82 (1.40 - 2.24)	--	2.87 (1.51 - 3.61)
All farms All Produce Types N=21	1.16 (0.32 - 2.14)	1.74 (0.92 - 3,38)	2.18 (1.40 - 3.15)	1.35 (0.70 - 2.64)	3.42 (1.51 - 5.25)
All farms Greens Only n=16	1.23 (0.58 - 1.93)	1.85 (0.98 - 3,38)	2.42 (1.43 - 3.15)	1.35 (0.70 - 2.64)	3.37 (1.51 - 4.99)
All farms Non-greens N=5	0.93 (0.31 - 2.14)	1.39 (0.92 - 1.72)	1.82 (1.40 - 2.24)	--	3.58 (2.12 - 5.25)

*n=3 for Farm 1, Farm 1 Greens Only, and All farms Greens Only. n=2 for Farm 3. n=5 for All farms All Produce Types.

**n=8 for Farm 2, All farms All Produce Types, and All Farms Greens Only.

Intentional Contamination

The pellet form of goat and llama manure added to 10 gallons of water yielded low *E. coli* results. Greater *E. coli* counts were achieved with manure slurry (Table 3), so llama slurry was selected to test the upper range of treatment effectiveness.

Species	Number of pellets	Preparation	<i>E. coli</i> (MPN / 100 ml)
Llama	5	Pellet	77
Goat	20	Pellet	15
Goat	20	Slurry	193
Llama	15	Slurry	>2420*

Four triple washes were conducted with 15 llama manure pellets in slurry preparation. Initial wash readings varied widely, from 840 - 173,290 MPN / 100ml *E. coli*. Reduction rates were consistently high for all samples. Average reduction rates were significantly higher for double and triple washes

and half-rate SaniDate® 5.0 in the first wash than similar reduction rates for farms (p<.01). See table 4.

Table 4. Mean and (range) Percent and Log10 Reduction <i>E. coli</i> Intentional Contamination n=4					
Reductions	Double Wash	Triple Wash	Double Wash + Half-rate SaniDate® 5.0 *	Single Wash + Half-rate SaniDate® 5.0	Single Wash + Full-rate SaniDate® 5.0
% Reduction	97.8 (96.7- 98.6)	99.9 (99.8 - 100)	100 (100 - 100)	99.5 (98.1 - 100)	100 (100 - 100)
Log10 Reduction	1.69 (1.48 - 1.85)	3.22 (2.81 - 3.65)	4.38 (3.23 - 5.54)	3.39 (1.71 - 4.57)	4.38 (3.22 - 5.54)



Photo 2 – Intentional Contamination Samples Collection bottles containing water samples from the first, second and third washes (left to right). The first sample is tan, but the second and third samples are clear. Samples showed this trend throughout the study; although data was not collected there was no apparent correlation of turbidity with the level of *E. coli* in wash water.

Conclusions:

Incoming *E. coli* levels varied widely (0-8900 MPN / 100ml) throughout the study period. High levels were not necessarily associated with turbid water as first washes were often turbid even when levels of *E. coli* were very low. High levels of *E. coli* were primarily observed early in the study period on all farms. This study did not assess potential causes for high *E. coli* levels, but did demonstrate that very high levels can occur in the absence of obvious cues suggesting contamination (e.g., extreme weather events, dirty water after washing).

Additional produce washes beyond the first wash greatly reduced the amount of *E. coli* in wash water. On average, *E. coli* levels are reduced by 88% with double washing and 97% with triple washing, demonstrating that large reductions are possible without the addition of sanitizer.

The addition of an OMRI-approved sanitizer, SaniDate® 5.0, at concentrations recommended by the manufacturer most successfully and consistently reduced *E. coli* counts (99.8%). In 17 of 21 samples, reduction was 100% (meaning no *E. coli* was detected in wash water samples). The addition of SaniDate® 5.0 to the first wash at half the recommended concentration did not reduce *E. coli* levels to the same extent and was comparable to double washing, particularly for greens. Although our sample size is small, the addition of a half rate of sanitizer to the second wash produced results similar to triple rinsing and the use of a full dose of sanitizer in the first wash.

The intentional introduction of manure resulted in highly variable *E. coli* counts. It is possible that the manure (and by extension the *E. coli*) was not evenly distributed through the wash water. If manure aggregates were present, sampling could under or over represent the average number of *E. coli* in the wash water. Large reductions were seen in these washes, likely because the *E. coli* was introduced into the water rather than via produce. The five minutes of wash time may not have been sufficient for *E. coli* to adhere to plant tissues. These samples may better represent reduction achieved when clean produced are exposed to bacteria through cross contamination. Because these reductions are not consistent with on-farm reductions, we do not feel that we can assess the level of *E. coli* in which the practices of triple washing or the addition of SaniDate® 5.0 are overwhelmed using these data.

Although limited, on-farm data provides the best information on the limits of the system. For all incoming *E. coli* levels, there was $\geq 97\%$ reduction with a full concentration of SaniDate® 5.0 in the first wash. Triple washing was able to reduce *E. coli* counts to < 100 counts in 19 of 21 samples. The initial (first wash) counts associated with the triple wash counts ≥ 100 were high (8900 MPN / 100ml and 4080 MPN / 100ml).

Study Limitations:

This study has several limitations. First, we used generic *E. coli* levels in wash water as a proxy for *E. coli* on produce. It is possible that the levels of bacteria clinging to or absorbed by the produce are not reduced to the same level as bacteria present in wash water. The levels in wash water reflect the bacteria that were dislodged from the produce, not the levels that continue to adhere to the produce which will be ingested by consumers. It is the presence of pathogens **on** food, not in the wash water, which is the direct public health concern.

Second, our study uses generic *E. coli* as a proxy for pathogenic bacteria such as *Salmonella*, *Campylocater* and pathogenic *E. coli* that could also be in vegetable wash water. The use of ubiquitous generic *E. coli* was a necessary first step for on-farm testing, as pathogens are much less common and it is unacceptable to introduce them into the on-farm setting for the purposes of research. It is possible that the same level of reduction is not achieved by triple washing and/or the addition of sanitizer for pathogenic bacteria, viruses or parasites as we observed with generic *E. coli*. However, the availability of a low-cost lab test for generic *E. coli* in water makes it a practical indicator for farms to use in managing food safety risks that may be associated with vegetable wash water.

Although the presence of *E. coli* in wash water indicates a potential pathway for contamination of food with human pathogens, there are no standards or guidelines for levels of *E. coli* in wash water, nor have studies been conducted that estimate the risk of foodborne illness associated with wash water *E. coli* levels. Therefore, we are unable to calculate the risk reduction of foodborne illness attributable to triple washing and the use of disinfectant in wash water.

Finally, intentional contamination of wash water with mammalian livestock manure may not reflect natural contamination events within farm ecosystems. The goal of intentionally contaminating the water was to estimate the *E. coli* levels in initial wash water at which a triple wash system and the addition of sanitizer are overwhelmed. The high reductions levels suggest that this system was dissimilar to natural on-farm systems.

Project Partners:

The following partners contributed to this project:

Vermont Agency of Agriculture, Food and Markets – Proposed a produce safety project relevant to Vermont’s agricultural scale; provided grant oversight.

University of Vermont Extension – Designed and implemented the study; conducted analysis and disseminated results and recommendations; recruited Farms 1 and 3.

Vermont Vegetable and Berry Growers Association – Reviewed the project for acceptability and relevance; recruited Farm 2 for participation in the study. Study results will be presented at the annual meeting in January 2013.

Vermont Department of Health – Conducted laboratory analysis of wash water samples.

GOALS AND OUTCOMES

The goals of the wash water study were to:

1. Determine the effectiveness of two procedures in reducing *E. coli* levels in leafy greens wash water to include triple washing without sanitizer, and single washing with an organic (OMRI-approved) sanitizer.
2. Assess the level of *E. coli* contamination at which these treatments are no longer effective.

Goal 1 was successfully achieved. Reduction rates were calculated for double and triple washing, as well as the addition of an organic sanitizer in full and half doses to a single wash. In addition, part way through the study period, we began collecting data on a half dose of sanitizer added to the second wash.

Goal 2 was partially met. UVM intended to assess the level of *E. coli* contamination at which the treatments were no longer effective through the intentional contamination of a first wash. This methodology proved to be inadequate for this purpose, as initial bacterial loads were highly variable and reduction rates were consistently higher than on-farm sample sets. They were able to partially assess this goal through the naturally high incoming bacterial loads observed in on-farm samples.

BENEFICIARIES

This study is applicable to most of the estimated 500 produce growers in Vermont, specifically those growing greens. The results are generalizable to produce growers outside of Vermont who have small to mid-size operations.

This is a first step in accumulating scientifically-backed recommendations for washing produce in small and mid-sized operations with the ultimate goal of preventing foodborne illness associated

with eating fresh produce. Specifically, triple washing and a full dose of organic sanitizer reduced E. coli in wash water 96.9% and 99.8%, respectively. Improving on-farm food safety practices can open up additional markets for growers as buyers become increasingly interested in on-farm food safety practices.

LESSONS LEARNED

Triple washing produce and using the manufacturer's recommended full dose of SaniDate® 5.0 appear to be very effective in reducing E. coli levels in wash water, suggesting that the adoption of these practices will improve on-farm food safety. A half dose of SaniDate® 5.0 added to the second wash may also be an effective treatment, but additional data are needed.

Double washing and adding a half rate of SaniDate® 5.0 to a single wash reduced E. coli in wash water, but to a lesser extent than the treatments mentioned above.

The on-farm study methodology provided consistent results with an observed dose response, and appears to be a promising methodology for assessing the effectiveness of triple washing and sanitizer.

The introduction of livestock fecal material into the first wash water does not appear to approximate contaminated produce, but rather may be more similar to a cross contamination event (which we did not assess in this study). Incoming bacterial loads were highly variable and reduction rates were unexpectedly high. We do not recommend this methodology as a means of assessing the effectiveness of triple washing and/or the use of SaniDate® 5.0 in reducing E. coli with high incoming bacterial loads. Instead, we suggest using the on-farm methodology over a study period that includes the entire Vermont growing season to increase the chances of naturally occurring high bacterial loads.

Future studies should test produce rather than wash water for E. coli and/or pathogen levels after various washes and/or sanitizer treatments. Although the laboratory analysis is more complex, these results would provide a better assessment of actual food safety risk.

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