



WEST VIRGINIA DEPARTMENT OF AGRICULTURE

SPECIALTY CROP BLOCK GRANT PROGRAM

FINAL REPORT

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PROJECT TITLE

Assessing Opportunities for Maple Syrup Production on Abandoned Mine Lands

Amount Awarded: \$17,350.00: Amount Expended: \$17,499.55

Project Summary

West Virginia has an expanding maple industry. A number of new producers are beginning to explore the potential of tapping maple trees to produce maple syrup and other value-added products. One factor preventing more landowners from entering into the business is a limited maple resource itself. Traditionally, maples are not tapped until they are at least 12 inches in diameter, which is approximately 60 years old. Unfortunately, landowners with no maple trees or small ones, will not expect to tap trees in their lifetimes. However, new techniques are being explored that afford opportunities to tap very small trees that may be only 5-10 years old. This allows individuals to plant trees with the expectation of tapping them within a few years. One of the largest sources of underutilized open land in the state is abandoned mine land. If sap extracted from maples grown on abandoned mine lands can be shown to be free from heavy metals and other undesirable compounds, there is a substantial resource that can be utilized to expand the maple industry in the central Appalachian region.

One of the newest innovations in the maple syrup industry involves harvesting sap from maple saplings. Small saplings are cut 4-5 ft from the ground. Plastic bags are then attached to the cut stems and attached to vacuum to extract sap (Fig. 1). After the sap season, the bag is removed and a crown reforms via sprouting. In subsequent years, the stem is cut 6-12" below the previous cut. Eventually the entire stem is cut off and many new stems re-sprout from the base. Individual sprouts are selected and decrowned in future seasons allowing the remaining sprouts to achieve sufficient growth before pollarding again.



Figure 1. Sap collection from maple saplings.

The researchers responsible for developing this novel technique for extracting sap also boast remarkable sap production. According to one of the researchers, Dr. Tim Perkins (Univ. of Vermont), a traditional sugarbush produces about 40 gallons of maple syrup per acre of forest by tapping around 80 mature trees. With this new method, the estimate increases exponentially to 400 gallons of syrup per acre when collecting from about 6,000 saplings. This work can be accessed at: <http://www.uvm.edu/~uvmpr/?Page=news&storyID=17209>.

The implications of this research offer substantial opportunities for WV landowners as well as the WV Maple Syrup Producers Association. However, an obstacle for many interested landowners is simply the lack of large maples to tap. This new method of harvesting sap demonstrates that large

trees are not needed to make maple syrup. Landowners with small landholdings may elect to plant maples on their property and could conceivably begin operations in only a few years.

Another substantial opportunity afforded by this method is to take advantage of the many old reclaimed surface mines are a prominent part of the WV landscape. Over 200,000 acres are either barren or covered with non-productive cool season grasses (Maxwell et al. 2012) in WV. Converting some of this acreage into maple plantations could greatly expand the state's capacity for maple syrup production in a few short years. Skousen and others (2006) reported red and sugar maples successfully growing on a number of former surface mines in WV.

The goals of this project were (1) to compare sap chemical content from maple trees growing on forested sites to mine land sites, and (2) to establish two small plantings that will demonstrate proper planting techniques and provide opportunities to showcase new extraction techniques. This project was an extension of previous and continuing activities associated with maple syrup production in West Virginia. A previous grant was used to promote the maple syrup enterprise within the state through education and experiential learning. The previous SCBG demonstrated how landowners could take advantage of the maple resource already present in WV. This current grant focused on demonstrating how landowners could take advantage of idle land, specifically former surface mine land, to enhance maple production throughout Appalachia.

Project Approach

Maple sap was collected from six sites that were forested and not previously mined for coal. Two sites were located on Preston Co., two in Randolph Co., and one each in Monongalia and Harrison Co. Sap was collected from an additional six sites which were previously mined, but are now reclaimed. These reclaimed mine sites were located in Preston Co. (2), Monongalia Co. (3), and Upshur Co. (1). Availability and access prohibited pairing of adjacent sites. Sap samples were collected using a portable vacuum system (Fig. 2). At each site, one or more trees were tapped and connected to sap collect vessel. The vacuum was applied for approximately 5 hr. A portable generator was used to power the vacuum pump.

Samples were collected in 2015 and 2016. Each sample was a composite of all sap collected. 50 mL subsamples were taken from the bulk sap and frozen until chemical analyses could be performed. All samples were analyzed in duplicate through University of Vermont's Inductively Coupled Plasma (ICP) instruments. Sugar content was assessed using a Misco digital refractometer.



Figure 2. Example of field setup of vacuum system for sap collection on mine site.

The planted areas were established in the spring 2015. A total of one acre was planted using 1-0 sugar maple seedlings from WV Division of Forestry Clements Tree Nursery. Additional 1-0 black walnut and 1-0 red maple seedlings were planted from the same nursery to provide a comparison of tree species used to make syrup. Weed control was performed periodically over the three-year period to reduce weed competition.

Partners were instrumental in collecting sap samples for chemical composition analysis. Partners were members of the WV Maple Syrup Producers Association. Additional cooperation by the various owners of the mine sites (e.g., coal companies) is acknowledged, as their openness made this work possible. Owners of former surface mines allowed us to collect sap samples from reclaimed surface mines, and a current owner allowed us to plant a recently reclaimed area in Grant Co., WV to assess survival and growth potential of maple seedlings. The West Virginia University farm also allowed us to utilize a former pasture to demonstrate the potential to establish a sugarbush through planting.

Goals and Outcomes Achieved

Planted Seedling Demonstration Area

One acre was planted between the two planting demonstration areas. One area was a former surface mine owned by Vindex Corp. and was located in Grant Co. The other site was on the WVU Stewartstown Farm in Monongalia Co.

One-year old sugar maple seedlings were planted at each site in 2015. After 3 years, seedling survival was quite low. Survival on the mined site was only 44.6%. Similar survival was recorded on the non-mined site after the first year. Even with replanting after year 1, sugar maple survival on the non-mined site was only 67.2% after three growing seasons. Large differences in growth rates were observed between the two sites. Seedlings on the mined site averaged only 4.1 inches, whereas seedlings on the non-mined site averaged 16.6 inches. Most sugar maple seedlings on the mined site showed a significant amount of dieback.

I also monitored the growth and survival of two additional species. Red maple seedlings were planted on the mined site (Grant Co.). Compared to sugar maple seedlings (44.6% survival, 4.1 in tall), red maple seedlings performed much better and were seemingly more adaptable to the conditions of reclaimed mine sites. Red maple seedling survival was 72%, and heights averaged 10.7 in tall. Black walnut was planted on the non-mined site (WVU Farm) as a comparison to the sugar maple. The walnut seedlings also outperformed sugar maple seedlings with 74% survival and an average height of 24.5 inches.

The results of these demonstration plantings suggest that getting sugar maple seedlings to a manageable size is going to be challenging. On the non-mine site, with seedlings averaging less than 1.5 ft tall after 3 growing seasons, the trees won't be sufficiently sized for another 15 years. While growth was somewhat better on the non-mine sited, we should expect the seedlings will need another 10 yr before coppicing can commence.

The demonstration sites were promoted in four field tours (~100 total participants) and two West Virginia University class visits (24 participants).

Additionally, 2 presentations were given promoting tree planting for maple production.

- J. Schuler. Sugarbush Management. Forest Stewardship Worskhop, Flatwoods, WV, December 2016. ~70 attendees.
- J. Schuler. Tree plantings and related aspects on former surface mine sites. 10th Annual WV Brownfields Conference, Morgantown, WV, September 2015. ~50 attendees.

Although no landowners have established plantings since the initiation of this project, at least one landowner is planning to establish a planting in the near future.

Sap Chemistry

Chemical composition of sap from maple trees growing on mined and non-mined sites is reported in Table 1. Between mine and non-mine sites, elemental concentrations in sap samples were generally small, but somewhat variable. However, differences in phosphorus, sodium, iron, manganese, copper, and zinc concentrations were $\geq 30\%$ between the sites. Of these, only copper and phosphorus were elevated on mine sites. The magnitude of these differences were at most a few ppm.

These sap concentrations were then compared to a northeast regional estimate (Perkins and van den Berg 2009). Large differences were noted between the WV sites sampled and the regional average. Across all sites sampled, concentrations for most elements were lower than the regional averages. For non-mined sites, sap samples had three elements with higher levels. Specifically, sodium was 7-fold higher, while boron and sulfur both had more than twice the regional averages. Similarly, for mined sites, phosphorus, sodium, boron, and sulfur exceeded the regional estimates by 93, 341, 75, and 123%, respectively.

Table 1. Concentrations of select elements in maple sap collected from maples trees growing on former mine and non-mine sites in West Virginia.

Element	Non-mined	Mined	Perkins and van den Berg 2009	Non- mined†	Mined†
	-----ppm-----				
Calcium	28.265	24.238	50	Low	low
Phosphorus	0.473	1.254	0.65	Low	high
Potassium	42.585	51.942	65	Low	low
Magnesium	3.175	2.987	5.6	Low	low
Sodium	0.588	0.353	0.08	High	high
Iron	0.023	0.016	0.04	Low	low
Manganese	2.822	1.279	3.5	Low	low
Boron	0.168	0.140	0.08	High	high
Copper	0.044	0.061	0.5	Low	low
Zinc	0.478	0.098	0.55	Low	low
Sulfur	1.711	1.719	0.77	High	high

†Comparing elemental concentration of mine or non-mine site to the regional average.

Sugar concentration was low for both mined and non-mined sites. Mine sites averaged 1.40 °Brix (ranging from 1.1 to 1.6 °Brix), and non-mined sites averaged 1.52 °Brix (ranging from 1.1 to 1.8 °Brix). On average, the pH of the sap was higher on mine sites (6.77 vs. 6.16). Interestingly, the lowest pH (5.2) from an individual site was from a non-mined site in Preston Co., and the highest pH (7.1) was from a mined site in Monongalia Co.

Beneficiaries

The beneficiaries of this research include members of the West Virginia Maple Syrup Producers Association (WVMSPA), other maple syrup producers, mine land owners, and reclamation specialists. This work highlights potential utility of reclaimed surface mines for use in the tree

syrup industry. Given the amount of land potentially available, seedlings grown to produce syrup can be a viable alternative if seedling growth rates and survival are improved. However, with the downturn in the coal economy, coal companies are not showing much interest in investing additional monies toward reclamation, especially for maple production. Under current bonding requirements, reclamation to grass is more cost-effective and simulates bond release more quickly than reforestation.

Maple producers can be reassured that even on highly impacted mine sites, maple sap chemistry and sap properties are not substantially affected. And while sap chemistry differs from regional estimates, these differences are what makes WV syrup uniquely different from other states.

A manuscript reporting the chemical difference of sap between sites is being finalized for submission early in 2018. This will broaden the audience of this work.

The beneficiaries of this project came from diverse audiences. The results and the opportunities afforded by expanding maple trees onto non-forest areas was presented to a number of professional groups at many venues. Specifically, the results of this work were presented to professional foresters, land managers, reclamation specialists, and current maple syrup producers. These audiences included attendees of Forest Stewardship meetings (80 attendees), Annual Small Farms Conference (40 attendees), Brownfields and Mine Drainage Conference (60 attendees), consulting foresters (6 members), and maple syrup producers training workshop (38 attendees). Additionally, over 80 students attending various natural resource programs at WVU visited the demonstration sites and learned about this research.

Lessons Learned

A number of lessons can be found in this research and demonstration project. First, the seedling morphology and physiology of the nursery planting stock must be altered to increase the probability of successfully establishing maple seedlings for the coppice system described here (or for any other purpose). This may lead to the development of a new production system at the nursery-level to overcome the slow initial growth and low survival. Establishment on mine sites (often droughty) requires a robust root system. Producing seedlings that have more developed root systems (e.g., more under cutting, older seedlings, containerized planting stock) and more conservative aboveground biomass may be better suited to difficult site conditions. This will reduce the large occurrence of stem dieback experienced by many of the sugar maple seedlings.

Secondly, we should also consider alternative tree species. The other seedlings planted in the vicinity of the sugar maples performed better. Red maple seedlings on the mined sites had 30% greater survival and over 2.4 times the growth. Red maple is known for its plasticity and is one of the most common tree species in the state. It is an excellent sprouter and may be well-suited for the same coppicing treatments described above. The slightly lower sugar content is of small consequence when one considers the superior growth and survival, and reverse osmosis technology. Similarly, black walnut performed better than sugar maple on the non-mine site. On average, walnut seedlings were almost 50% taller and had slightly better survival after 3 growing seasons. Many black walnut seedlings are starting to show 1+ ft height growth per year. On good sites, black walnut can outgrow maples. However, it is very site sensitive and doesn't grow well on dry or strongly acid sites.

Even though the science showed that the chemistry of maple sap from trees growing on former surface mines was similar to trees growing on non-mined areas, there appears to be hesitation in adopting such an extreme practice for increasing access to maple trees for syrup production.

Growth rates and survival on the mine site highlighted the challenges of establishing sugar maple seedlings. The relatively low survival and almost no growth will likely keep most operators from using sugar maple seedlings. Given the results, their performance bond under a forestry landuse will not be released. However, the results do show that red maple has potential. Red maple grew better and had higher survival than sugar maple. In the future, there may be opportunities to expand nursery research to develop cultural practices that produce seedlings with physiological characteristics that are better able to survive and grow under the challenging conditions on mine sites (i.e., target seedling concept). Coupling improved seedling quality with tree breeding to favor seedlings with high sugar concentrations (analogous to “super sweet” seedlings), will make adoption more likely.

Lastly, a series of protocols for establishing tree cover on reclaimed mine lands, referred to as Forest Reclamation Advisories (FRA), document desirable practices for reclaiming sites using trees. A major focus of these advisories is to ensure operators create a suitable soil environment for promoting root growth. Despite this, many contractors compact the subsurface soils to prevent erosion on sloped surfaces. Additional training showcasing the advantages of non-compacted soils and suitable cover crops will enhance the success of these plantings—possibly increasing their acceptance.

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Program Income

No program income generated.

PROJECT TITLE

Cryopreservation of Honey Bee Germplasm

Amount Awarded: \$9,500.00: Amount Expended: \$9,329.23

Project Summary

The West Virginia Queen Producers Initiative proposed to implement a cryopreservation unit. The equipment would aid in the advancement of the honey bee breeding and selection program. By the year 2016 the acquired unit was placed to the test, and successfully used to freeze and store some collected honey bee drone semen. With the frozen semen, we were able to thaw it out, and proceed to inseminate our first batch of queens, from which we grafted and reared daughters that were ran through our selection program, and those selected, were used as breeders in the 2017 season.

Project Approach

The funding of this project allowed the West Virginia Queen Producers Initiative (WVQP), to acquire the minimum necessary equipment, and coupled with the appropriate skill set of the collection of honey bee drone semen, and the cryopreservation technique, allowed the WVQP to incorporate it into our breeding and selection program at the local level (state side). With the proper breeding and selection of honey bees, we expect that the honey production per each hive that houses one of the program queens, on average, in the state of West Virginia, will improve production levels under the appropriate conditions. It is noteworthy to clarify, that this equipment is not the cause of the increase in production of our honey bees, this improvement is the result of years of careful and meticulous breeding and selection of our honey bee stock. The equipment is simply a tool that allows us to pause our breeding and selection program when adverse conditions are present (drought, winter), and then resume the program when conditions are once again favorable for the rearing, breeding and selection of honey bee queens.

Despite the timely submission of the requirements for this grant, we were not approved to move forward until the year 2015, so our timeline was not carried out as submitted. Our project began with a train the trainers workshop in 2015, where our SME's provided instruction to the group. We were exposed to the equipment and accessories, pros and cons, and the many advantages of including this process into our breeding and selection program.

Once the funding approval was received, we proceeded to procure the equipment. The storage tank, and transport unit were the first to be acquired in the late summer early fall. The freezer unit, and the rest of accessories were purchased at a later date.

In the year 2016 we visited the Washington State University, and spent some time with our SMEs reviewing the technique and procedures in real time. That was time well spent. The grant did not allow funding for this so this was a well worth out of pocket expense.

Upon returning from WSU, we proceeded to put in practice what we've learned and were able to collect and freeze our first batch of semen, and use this to inseminate some of our queens. From these queens we reared daughters for future breeders in the 2017 season. The equipment was reviewed and all major goals in terms of acquisition, training and demonstration were accomplished. Widespread us among Association members is ongoing and did not meet initial goals, however, the project will be available to producers for future genetic progress as well as events and training. Presentations are ongoing. Availability of the equipment has been promoted at the local and regional beekeeping groups, state meetings, events (Honey Festival) and articles in statewide newsletters describing the technology and benefits.

Goals and Outcomes Achieved

During the 2017 season we were able to graft from our breeder queens. Those daughters were open mated and evaluated in our local yards and some were disseminated among beekeepers. The feedback received regarding the performance of the queens was very encouraging. We've developed an evaluation spreadsheet that we will share this coming season with other beekeepers. The goal of the spreadsheet is for the testers to enter specific data that will aid in our evaluation process.

The train-the-trainer workshop took place in the initial phase of this project.

The community is very much interested in genetic improvements of our honey bees. One of the main issues we are finding is the low fertility rates when using the frozen semen. Upon going back to the scientific community with the issue, it seems that the low fertility and reduce longevity of the queen is caused by the cryoprotective agent (CPA), in our case dymethyl sulfoxide (DMSO). Some scientist are proposing as a way of minimizing this issue, to apply a semen wash after thawing, prior to using the semen to remove most of the CPA. The WVQP is working on fund raising plan for the additional equipment required to accomplish this task.

We plan on inseminating another batch of queens early in the 2018 season for evaluation and production of breeder queens, as well as, production queens.

In essence, a well-managed honey bee breeding and selection program, that include the ability to store semen for future use is a positive aid in producing multi-generational queen bees.

Careful planning and meticulous record keeping is strongly encouraged.

We will continue our efforts in the improvement of our West Virginia honey bee breeding and selection program, and more heavily so now that we have a tool that can allow us to hit the pause button when conditions are not favorable for the rearing of queens, and resuming as conditions become favorable once again.

Project delays and difficulties generating interest in the benefits and technical implementation of the project provided challenges, however, recent interest in utilizing the equipment for managing and growing bee colonies in the state became evident in the final stages of the project. A survey was not implemented due to limited usage.

Beneficiaries

The direct beneficiaries of this specialty crop project, were all the twelve members of the West Virginia Queen Producers Initiative, being directly involved in the rearing, breeding, and selection of queen honey bees. As part of the indirect beneficiaries of this project are first the beekeeping community in general, and second our orchard industry, by making available productive bees.

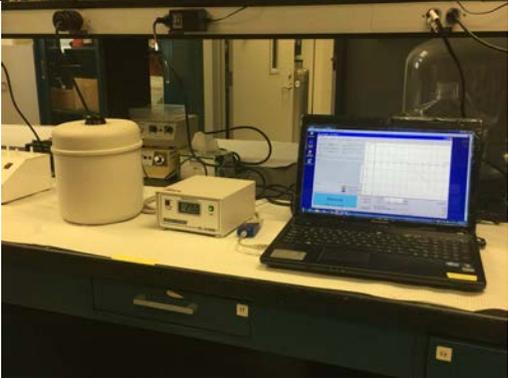
Lessons Learned

During this project, we've learned that when applying for this type of projects, one should add enough flexibility in the timeline to allow for any delay in the funding approval. In our case that delay in approval send our project into a one-year delay due to the fact that once the approval came the season and favorable conditions were long gone and we had to wait for the next season to take action.

One thing that was evident is the struggle to get the involvement of the community as citizen-scientist. Participants will provide data as observed, but will not be meticulous with the data collection based on guidelines provided. However the main lesson is that this technology, as it pertains to cryo-preservation of honey bee germplasm, is in its infant stage, and has great room for improvement and until we can find a stable approach, it will remain an ongoing open project. We hope to gather funds soon enough to procure the necessary equipment to attempt the CPA wash and/or a combination of different CPAs and will test results thereafter.

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PROJECT TITLE

KISRA Farm Expansion

Amount Awarded: \$10,000.00; Amount Expended: \$8,350.35

Project Summary

The main element of the project was an addition of an aeroponic vertical tower system to KISRA's Paradise Farms. This addition allowed for a comparative research for specialty crop production – in particular, for side-by-side comparisons of cost and yield. This research led to a decision about which system is the most economical while documenting best practices and good management procedures. This information will be shared with others who are faced with a similar infrastructure looking for alternate and economic growing systems leading to grower productivity.

SCBG funds were used to study the growth of various specialty crops in three settings. In particular, a study of lettuce grown in a raised bed, hydroponic NFT (nutrient film technique), and a vertical tower was conducted. By conducting this research we provided a benchmark for new and existing growers who are considering the advantages and disadvantages of growing in one of the three ways presented in our study.

Project Approach

Before our SCBG project began, KISRA converted our two Dunbar greenhouses from soil-based raised bed growing to hydroponic NFT tray production. This allowed us to experiment further with controlled growing operations, a process which began with the construction of the greenhouses in 2013. The SCBG project funds allowed us to purchase 13 aeroponic towers for the purpose of research with our partner WVSU Extension.

We wanted to test the difference between three methods of growing in an urban environment: vertical aeroponic towers, hydroponic NFT trays, and dirt in raised beds. We wanted to measure which grows the fastest, produces the most yield per square foot, and tastes the best. Hydroponic and aeroponic systems are significantly more expensive than dirt growing, but they are also significantly less resource intensive. We wanted to compare the yield and growing cycle in order to determine which system is most cost-effective overall. We focused on lettuce because that was the specialty crop that seemed simplest to compare across mediums, and the crop which we have focused on growing.

To compare, we planted lettuce in each system three times. At our Parkersburg facility, we planted the first lettuce crops in the towers in fall 2016, and harvested it in Spring 2017. All other crops were grown at our Dunbar facilities. The NFT trays were located in Greenhouse #1, and we grew continually in them throughout 2016 and 2017. The dirt-grown lettuce was grown in pots in Greenhouse #2 and in a raised bed outside. The two final cycles of aeroponic growing happened in towers in Greenhouse #2.

The results were that lettuce growing was more difficult and precarious in the towers than in the NFT system. It took longer to grow harvestable lettuce in the towers, and the lettuce was more likely to die in the process. Dirt growing took considerably longer than growing in the towers, but the plants were less likely to perish.

For our purposes, we consider this study an accomplishment; we now know that we should focus on NFT trays for our lettuce production. We also learned that other crops – including heavier leafy greens like kale and chard, and several varieties of herbs – grow easier in the towers than the channels, although we need to study this more. We would consider this latter fact to be a favorable development.

West Virginia State University Extension, our partner for the grant, helped KISRA develop the research plan which we followed: three trials of three different growing methods for the same crop. We had intended to get assistance from WVSU in evaluating the success of our research project, and to help us create a white paper to illustrate the opportunities for production of specialty crops in the aeroponic vertical towers in comparison to raised beds and NFT systems. However, during the grant period, the staff at WVSU Extension experienced significant turnover; none of the members of the original partner team are still with the organization. We have reached out to the new staff at WVSU Extension, and will continue to try to collaborate with them on the production of the white paper, but no timeline has emerged as of yet. In a less formal fashion, KISRA has been able to disseminate results and communicate these results to growers who have been involved in the KISRA Growing Jobs Program. We have communicated orally, and over emails, the broad shape of our research project, and the results we had from it, to other growing partners across the state, including Refresh Appalachia. In conclusion, we would recommend that any growers who want to grow quick, consistent, and easy lettuce crops ought to consider a hydroponic NFT system. These are expensive systems, and we all know that the margin on lettuce sales is slim. So we would recommend extensive local market analysis before purchasing any non-traditional growing system. But, when compared head-on with aeroponic towers, the NFT tray system is superior at lettuce growing.

Our first test of the towers began with planting on October 3rd, 2016. We tested in the high tunnel at our Parkersburg site. Here are the notes from our former employee, Mandy Bailey, from her planting date: “Grodan rockwool cubes were soaked for a few minutes in mildly acidic water. Trays that were brought to me have all the drainage holes. I found blue roll of plastic left by WV Department of Agriculture (WVDA). The plastic was cut to overlap trays and used to provide leak free trays to keep rock wool and potential seedlings moist... After seeding, all seeds were lightly covered with vermiculite.” She also notes that she planted 28 seeds of Skyphos and 28 seeds of Vulcan lettuce.

By October 11th, all 28 of the Skyphos seeds had sprouted, and 26 of the Vulcan seeds had as well. By November 10th, all of the Vulcan seeds had sprouted, but three of the Skypos sprouts had died off. Also on this day, 11/10/16, the seedlings in their rockwool were planted in the towers. Mandy did not have access to a thermometer at this time, but estimated that the water and nutrient solutions were around 18-20 degrees Celsius. Several times, first on November 21st and last documented on December 15th (but presumably happening later in the winter as well)

outside temperatures dropped below freezing. Mandy often heated the high tunnel with a propane heater, but not always.

The lettuce was not ready for harvest until March 16th of 2017. The lettuce was comparable, in size, color, and flavor, to the lettuce grown in our Dunbar greenhouse in NFT trays. But our NFT-grown lettuce takes, on average, 4-6 weeks from seed to harvest. In contrast, the lettuce grown in the towers took 24 weeks from seed to harvest.

After this March harvest, we lost Mandy and the Parkersburg site. We relocated the towers to our Dunbar location, and spent several months equipping the greenhouse so that it could accept the towers. Our second batch of seeds was planted on September 18th, 2017. We planted 20 of the Vulcan seeds in the rockwool, and let them germinate in our packing house behind black plastic. Four days later, September 22nd, we transplanted all twenty of the seedlings into the towers. Three days later, September 26th, they were all dead.

Our third planting began with seeding on September 25th, and was the same as on the 18th: twenty seeds of Vulcan planted into rockwool and germinated in the packing house. Four days later, on September 29th, they were transplanted into the towers. And, again, by October 3rd, they were all dead. The grant period had concluded at this point.

Our first dirt planting happened in Dunbar simultaneous with our first tower planning in Parkersburg. We planted ten seeds in containers holding dirt in our second greenhouse. The plants took ten weeks to reach maturity, but we did not harvest them because they had burnt edges.

Our second and third dirt plantings were simultaneous with our second and third tower plantings in Dunbar. As of October 18th – one month after the first planting – the lettuce sprouts were too small for us to weed the bed without possibly harming the lettuce (picture attached; this was post-grant data but incorporated into our conclusions).

Over this period, we continued with our regular production of lettuce in our NFT trays in our main Dunbar greenhouse. On average, we had germination success rates or 90%, and the lettuce reached maturity in 4-6 weeks.

Goals and Outcomes Achieved

GOAL:

To assess the growth of specialty crops in raised beds, hydroponic NFT, and vertical towers through scientific evaluation of inputs and outputs including cost of production, efficiency, yields and consumer satisfaction/sales.

PERFORMANCE MEASURE:

1. Based on analysis of comparative data generated by the project, the following questions will be answered with corresponding numbers (i.e. assessment of efficiency will be

made by yield studies, efficiency of economics will be assessed through sales and market demand, job skill mastery will assess which method is appropriate for workforce training, etc.). The two results will explain:

- a. The most effective and efficient method of operation
 - a. For lettuce production, we believe we have shown that the NFT trays are the most effective and efficient method of operation. Our trials in the NFT trays had germination success rates or 90%, and the lettuce reached maturity in 4-6 weeks. Our only successful lettuce crop in the aeroponic towers took 24 weeks, and the towers had a germination success rate of only 33.3%. Dirt production of lettuce took 10 weeks to reach maturity when seasonal conditions were favorable, but when conditions were less favorable, lettuce had failed to reach maturity by 24 weeks. Our germination rates in dirt were 85%.
Sales and market demand did not seem to be correlated with growing methods. The dirt-produced lettuce was visually unsatisfactory, so we did not attempt to sell it. But our buyers were not aware of the differences between NFT trays and aeroponic towers, and did not seem to have a preference regarding lettuce. Some taste tests found that the collard greens and Italian parsley grown in the towers were slightly sweeter and less tough than their dirt-grown counterparts. But further research is needed before we can say that this aesthetic difference influences sales. This research project focused only on lettuce, and there were no perceived differences among lettuces regarding gustatory aesthetics and growing medium.
 - b. A baseline collection of data for future operations using the optimum method incorporating best practices, and lessons learned to demonstrate increased efficiency and effectiveness in the future
 - a. The data reported above, on effectiveness and efficiency, will serve as a baseline for future operations. We will attempt to become more efficient and effective than we were in this trial. As we continue to streamline our lettuce production, we will focus on the optimum method: growing in NFT trays. The best practice we have learned thus far is to restrict lettuce growing to NFT trays. The towers seem better fitted to growing herbs, darker leafy greens, and strawberries, but research on these crops was not a part of this SCBG research project.
 - c. Viability of continued expansion of chosen growing method
 - a. During the research project period, and continuing through to today, we have an entire greenhouse – 4,400 ports – dedicated to lettuce production in the NFT tray system. Because this greenhouse produces more lettuce than the market currently demands, we do not anticipate expanding NFT-based lettuce growing. Our research has shown that the NFT tray system is so efficient and effective at

producing lettuce that we can outperform current market demands. Accordingly, we are expanding growing different crops and using different methods, and plan to do research on more crops.

2. At least 10 growers/employees will participate in the program and generate at least \$1,000 of additional income per grower. The income generated will be reinvested back in to the project.
 - a. Specialty Crop Block Grant funds were not used to cover personnel costs, wages, salary, or benefits. We've only used these funds to purchase the aeroponic growing towers used for the research. Due to other funding shortfalls – unrelated to the SCBG project – we did not have the funds to employ 10 growers for this project. We were only able to have 4 employees participate. Due to the low rates of lettuce reaching maturity when grown in the dirt and in the towers, we did not achieve the intended goal of \$1000 per grower. We generated income of \$630 in total through sales of the crops harvested as part of this project.

BENCHMARK:

1. Purchase and install hydroponic NFT ports
 - a. This was accomplished in August of 2014, prior to the beginning of the SCBG research project.

NB: this benchmark was erroneously typed as “purchase and install hydroponic vertical ports,” both in KISRA’s original project description and in the request for clarification from the Department of Agriculture. Our only hydroponic system is an NFT system; it is one horizontal level. The only vertical ports we have are those within the aeroponic towers – the towers we purchased with the Specialty Crop Block Grant. Because KISRA’s original project proposal was written prior to my employment at KISRA, and because the proposal’s authors no longer work for KISRA, I can only assume that the wording of benchmark #1 was an unfortunate result of a typo.
2. Purchase and install vertical towers
 - a. The towers were purchased in October of 2014. In October of 2016, they were installed in our former Parkersburg high tunnel, where our former employee Mandy Bailey performed the first cycle of research in the towers. They were then reinstalled in our Dunbar greenhouse in May of 2017.
3. Compare growth of at least two crops grown in in raised beds, hydroponic NFT and vertical towers to determine baseline
 - a. This process began in October 2016 and ended in October 2017. We grew three crops. In addition to the one crop grown in towers Parkersburg in 2016-17, we grew two crops in the towers in Dunbar in 2017. We also grew three crops in dirt in Dunbar in this same time period, and more

than three successful crops in the NFT trays. As discussed in the “Performance Measure” section, 1a-1b, we determined a baseline of 90% germination rates with a 4-6 week period before lettuce reached maturity.

4. Create a technical bulletin describing the research and results for method evaluation for other growers.
 - a. We have compiled a bulletin from our SCBG annual reports and our final report. It is available for other growers upon request. We have also proposed to our partners at WVSU that this bulletin be published as part of a joint White Paper, but WVSU has not yet expressed interest in this project at the time of this report.

Beneficiaries

KISRA’s farmers are beginning and/or socially disadvantaged farmers. They benefited the most through the research because they learned farming skills they would not otherwise learn. Six KISRA members were able to participate in NFT growing of lettuce. Only four were able to participate in the entire project. The local farming community has also benefited from this project; we’ve had five visits from other farmers from West Virginia, and from the larger Appalachian region, who wanted to see hydroponic and aeroponic growing. Two of these groups have gone on to incorporate hydroponic elements into their farms. We intend to continue having tours and farm visits as long as we are in operation. We sold the crops grown in the towers and in the NFT trays – both the research lettuce and other crops – at local restaurants, at local grocery stores, and to a local foodbank. The research crops were sold for approximately \$630. We have also donated crops from our NFT trays to a local soup kitchen. So these local markets have benefited from increased sales, and customers – many of whom live in food deserts – have benefited from increased access to healthy foods. We project that the potential economic impact of the project could be as great as \$36,700 annually in sales of lettuce grown in the NFT tray system. We anticipate even greater economic impact in production of non-SCBG crop production in the towers and in raised beds, as great as an additional \$40,000 annually once we have finished our research in these areas.

Lessons Learned

In some sense, our goals were achieved: we learned that the hydroponic NFT trays are preferable to the aeroponic towers for growing lettuce quickly and easily. In another sense, we still have much to learn about growing in the towers. Our successful first cycle in the Parkersburg greenhouse shows that we can grow lettuce in the towers, so we will continue researching on what conditions are best for this task. But we will also continue researching to discover which other crops are better suited for growing in the towers. Because these systems are expensive, we would advise any potential grower(s) to heavily research their qualities before buying them.

Based on our limited research, it seems that the NFT system is the most ideal for growing lettuce. It is possible that the troubles we had growing in the towers were related to the weather; the Parkersburg cycle was cold with little heat, and the two cycles in Dunbar happened during an unusually warm September with a less efficient cooling unit than in our other greenhouse (with the NFT trays). It is also possible that the rockwool growing medium necessary for the towers is less hospitable for lettuce than the Oasis growing medium we use for the NFT trays. This does not mean that the towers are overall less valuable than the NFT trays. In Parkersburg, we successfully grew collards, kale, and chard in the towers, and in Dunbar we've successfully grown a wide variety of herbs in the towers. We were unable to grow these crops successfully in the NFT trays. So we plan on doing further research with the towers, even trying lettuce again in the winter.

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PROJECT TITLE

Maple Syrup Producers Association

Amount Awarded: \$7,200.00; Amount Expended (includes reallocation): \$21,072.86

Project Summary

A commitment by the agriculture sector to “tap” into the natural maple resources in the state as well as an organized effort to develop a strong, stakeholder led marketing effort were the needs that this successful project addressed. In order to create a viable commodity market, education, collaboration, organization and aggregation are the critical elements that a commodity association provides for this specialty crop in West Virginia. Providing resources, technical assistance and critical educational programs were the elements of this project that eventually became the foundation for a growing specialty crop industry in the state.

This was the initial maple syrup project in the state and created the Association as well as program and educational foundations that have led to other projects. It did not build on a previous award.

Project Approach

To accomplish the project’s goals, objectives and outcomes, the official formation of the West Virginia Maple Syrup Producers Association as well as organizational steps were implemented to provide a core leadership group that could assess and act on the needs and interests of the maple industry. Growing membership as well as production required formal steps that were requested on behalf of the organization rather than individuals. Events and outreach about the economic viability as well as consumer product introduction were included to introduce and establish buyer interest and impact. Using the research and production information for industry best practices were identified as well as partnership and collaboration linkages were critical for the project success.

As the project evolved and success occurred, the activities and outcomes continued to grow with this project. Strategic fund usage and results yielded opportunities for the group to expand on the stated outcomes and include more activities. An organizational meeting, election of officers, incorporation with the WV Secretary of State, 3 annual meetings and committee establishment were accomplished. Since 2015, the Association has had an educational display at the State Fair manned by members highlighting sap collection, processing and products centered around maple syrup. Additional exhibits were presented at the 2 WV Small Farm Conference.

An introduction to maple was provided to the visiting public in the form of an Association maple cotton candy machine that provided samples and feedback on sugar use for cooking and other product applications. Educational programs were conducted on tubing, marketing and best management practices with more than 150 attendees including state foresters who were able to use their educational time to renew continuing education credits. Seven workshops with Veterans and Warriors to Agriculture as well as grant support were conducted as an introduction to maple production program delivered statewide with more than 150 participants.

Recognition of the impact of WV maple production nationwide was another goal of this project to be accomplished through interaction at the International Maple Conference in the fall of 2016 in Pennsylvania. In addition to participation by 8 member farms, placement of a WV representative on the international board, an association display, participation in educational programs and submission of entries into international competition. One of the members, Family Roots Farm in Wellsburg, was named the international winner of maple sugar category (shock!) and Frostmore Farm placed in the maple photography competition. Networking with fellow producers, interaction with internationally recognized researchers and learning interactions made this event beneficial and productive. As of September 30, 2017, the Association had 42 members.

Work with the WV USDA State Statistician placed WV maple back on the national survey report where production and growth can be consistently measured. Record keeping supplies, maple density monitoring equipment and other teaching aids were purchased for association shared use and learning. From the 2017 WV Agriculture Statistics report, the two years of tracking yield the following:

MAPLE SYRUP

Maple syrup production totaled 9,000 gallons in 2017, up 3,000 gallons from 2016. Number of taps was 61,000, up 10,000 taps from 2016. Yield per tap was 0.148 gallons, this is up from the 2016 yield per tap of 0.118 gallons. On average, the maple syrup season opened on February 3, 2017 and closed on March 7, 2017. The average season length was 32 days. The first date sap was collected in West Virginia was January 5, 2017. The last date for sap collection was April 10, 2017. Average price per gallon was \$48.40 in 2016, and the value of production was \$290,000. Price by type of sale and size of container was withheld to avoid disclosure for individual operations in 2016, except for pints, at \$8.70 per pint in 2016. Bulk prices in 2016 were \$2.80 per pound and \$30.30 per gallon. Percent of sales by type in 2016 was 48 percent retail, 6 percent wholesale, and 46 percent bulk. Estimates for West Virginia began¹ in 2016, no data for 2015 are available.

Source: [https://www.nass.usda.gov/Statistics by State/West Virginia/Publications/Annual Statistical Bulletin/2017/Bulletin2017-All.pdf](https://www.nass.usda.gov/Statistics%20by%20State/West%20Virginia/Publications/Annual%20Statistical%20Bulletin/2017/Bulletin2017-All.pdf)

Though not part of the original grant activities, the initiation of “Mountain State Maple Days” The impact of this project has been tremendous and can be validated by increased interest, launched operations, production, and Association development.

Attendance at the 2015 International Maple Syrup Institute/North American Maple Syrup Council was a highly successful introduction into the national maple community. Eight West Virginia members were able to attend, the Association had a display, members attended educational sessions, WV was appointed a seat on the International Institute, two members placed in the photo category and the most amazing accomplishment was the international first place award for best maple sugar by an Association member. Participation in this event has continued as WV joins others in the international maple marketplace.

Initial attempts to create a strategic plan were difficult as the group experienced a slow start, followed by a spike in membership, as well as the capitalization of additional learning and marketplace opportunities. At this point, funding has dictated the progress of the group, strategic plans from other Associations as models have been gathered and focus groups planned for the future based on the foundational work accomplished by this award.

Beneficiaries

The beneficiaries of this project extend far beyond the 42 members of the Association. They include workshop and educational participants who have incorporated maple into their beginning farming plans, consumers who have access to local WV syrup in the expanding retail marketplace (15 retail outlets have added or expanded maple syrup SKU’s) with increased economic impact to producers. This grant was created to build a solid industry foundation in the state and the beneficiary reach is local, state, and regional in nature with the promises of potential and growth.

Goals and Outcomes Achieved

Baseline totals were documented by the 2016 NASS survey. Taps reported on during this season totaled 51,000 and gallons produced equaled 6,000 gallons.

At the conclusion of the project (/28/17), the Association recorded 42 active members.

Many events were conducted during the grant providing industry, Association and educational information. These included the 2015, 2016 and 2017 State Fairs, the 2017 national Boy Scout Jamboree (including the first ever gourmet food sales in the Trading Post and this video documenting

sampling: <https://www.facebook.com/West.Virginia.Department.of.Agriculture/videos/vb.2092>

[16192424001/1648445968501009/?type=2&theater](https://www.wvda.us/16192424001/1648445968501009/?type=2&theater)) , 2015 and 2016 WV Small Farm Conference, 2 presentations from Vermont’s Tim Wilmont on the technology and advantages of 3/16” tubing systems, maple forest management and tubing field days during the grant, recordkeeping and pipeline management materials for members as well as a confections demonstration at the Small Farm Conference. Participation in educational opportunities resulted in 387 participant interactions. Purchase of an Association cotton candy machine and model sugarhouse provided sampling and tasting opportunities for the public. These outreach efforts provided more than 8,000 sampling opportunities. During the 2017 State Fair of West Virginia, these outreach efforts translated into \$7,800+ of maple product sales which was the 2nd leading commodity sales category.

The Association was formally established, registered with the Secretary of State and has a pending non-profit application in progress as well as a third cycle of officer/board of director elections following the filed by-laws. Development of a five-year strategic plan is ongoing with focus groups and member input at the fore front of development.

At the conclusion of the project, the performance measure of a 15% baseline data increase in taps and gallons produced was achieved.

Year	# of Taps	# of Gallons
2016 (Baseline)	51,000	6,000
2017	61,000	9,000
Increase	+16%	+33%

Lessons Learned

As with any new commodity group, organization and sustainability are critical success factors that can be challenged by volunteer involvement. Establishing a new organization legally, developing program elements that benefit all and maintaining communication can be challenging. The interest in the formation of this group has been there and the leadership passionate about the product they are promoting. Through interest and support, this group has had the advantage of a commodity specialist who has an extensive background in maple and has served in a consultant capacity for many of the Association projects and continuing programs. Combined with a strong partnership from West Virginia University and their forestry management/maple production program, collaboration, resources and support have been critical for the success of this project.

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PROJECT TITLE

Maximizing Profitability and Productivity for Sustainable Multiple Vegetable Crop Production in West Virginia

Amount Awarded: \$16,000.00; Amount Expended: \$10,881.82

Project Summary

Many West Virginia growers have expanded their farming operation to include high tunnels, which protect, accelerate and expand the season for specialty crop production. Planting and first harvest are earlier in high tunnels, which also allow plant growth earlier in the spring as well as later into the fall. Using the high tunnel for one crop, such as tomatoes has been simple using information provided on the web and determining planting dates compared to field production. Currently no yearlong vegetable production schedule and associated enterprise budgets exists for high tunnel vegetable production in West Virginia. Thus, the plan is to undertake research with four growers to investigate crops, production and economic returns on vegetables grown in high tunnels to develop recommendations for high tunnel in WV. The team will meet quarterly to discuss progress towards the project goal. Draft production schedules and enterprise budgets will be produced December 2015 and 2016 with the final version produced in August 2017 for release. The success of the project will be measured by attendance at each of the presentations and by self-identified interest among high tunnel growers in using the schedules and enterprise budgets as measured through distribution.

Project Approach

Many West Virginia growers have expanded their farming operation to include high tunnels, which protect, accelerate and expand the season for specialty crop production. In this way, high tunnel growers are able to access main and lucrative early- and late-season markets. Vegetables are the main crops grown in high tunnels with the following crops, in order of importance: tomato, sweet pepper, cucumber, muskmelon, lettuce, summer squash, and eggplant. Researchers at Michigan State University estimate growing tomatoes in a high tunnel can produce \$5 per square foot of gross sales and salad mix can sell for as much as \$10/lb. However, in a study to evaluate how much revenue they were able to generate in a year, researchers found that net income ranged from -\$500 to \$5,000. This figure falls far short of the average cost of a high tunnel (\$10,000) to pay for the investment in one year as often quoted by a variety of sources. Many of the choices were based on management decisions and record keeping according to one of the researchers. If that is the case, then what are the best recommendations that we could make to WV growers to maximize their high tunnel space, time and production costs to grow more produce profitably?.

Finding information on how to grow a single crop in high tunnel, such as tomatoes, is simple using information provided on the web and determining planting dates compared to field production. However, most WV farms are not interested in growing a single crop in their high tunnel choosing instead to produce multiple crops and maximize profits. No schedule or recommendations exist

for WV growers for multiple crops at this point. Several growers have experience with growing selected crops, but there has been no concerted effort to research this issue. There is also concern among agriculture professionals with continual production of one or many crops within a high tunnel may create pest and nutrient build up issues that have not been assessed. The next logical step is to determine what crops and scheduling plans are necessary to maximize profit and yet maintain good sustainable agricultural practices in the high tunnel.

Weather stations are installed at all four sites. The weather stations deployed included an outdoor weather station to collect temperature, humidity, rainfall, wind speed and wind direction and two wireless temperature and humidity sensors that could be located in the high tunnel. Also a display, which connected to the growers' computer via an included internet bridge that allowed the weather data to be collected from station and sensors to be uploaded to the display as well as to an app that could be downloaded to a mobile device (similar to <https://www.acurite.com/weather-environment-system-01058.html>). Most growers had the display in a home or similar structure so they could monitor it during the day to know when conditions were changing requiring their attention at the high tunnel. Most helpful was the app for mobile devices, which allowed them to view this data in real time and setup custom or system alerts. For a cost of \$220 per system, this is an affordable system that can be used small growers. The biggest difficulty is if their high tunnel is too far from a structure or there is structural interference between the sight lines of the Internet Bridge and the weather station or sensors. Using a system such as this rather than relying on thermometers as written up in the IPM Chronicles (see below under publications).

No production schedules or enterprise budgets were developed. The growers proved to have too many variables in the production systems. These included what crops they produced, when they produced their crops (only in one season, in multiple seasons, etc.) and how they produced them (in soil, in raised beds, in pots, etc.).

High tunnel materials were supplied to all growers as well as seeds to all and a scale to one. These materials are being organized to be available electronically (website and/or Google Drive) for high tunnel producers in the state as well as being used by agriculture service professionals.

Beneficiaries

Four growers were recruited for the project. They are located in Kanawha, Putnam, Lincoln and Jackson counties. All four had at least one high tunnel and each has several years experience growing in a high tunnel.

Goals and Outcomes Achieved

GOAL: Develop production schedules and associated enterprise budgets to improve profitability and productivity in high tunnel vegetables production by small farm growers supplying locally produced food for consumers, markets and institutions in West Virginia.

PERFORMANCE MEASURES:

1. Report numbers of people attending trainings or workshops that we use the information.
2. Setup the information on a webpage so we can document the number of times the page is accesses.

We were unable to report any data for the performance measure. No production schedules and enterprise budgets were developed so no trainings or workshops could use them. As for posting them on a webpage, the one we would have put them on was taken down by the hosting institution during a redesign which did not allow us to post anything even if we had developed production schedules or enterprise budgets.

BENCHMARK: Currently no yearlong vegetable production schedule and associated enterprise budgets exists for high tunnel vegetable production in West Virginia.

We still have no yearlong vegetable production schedule and associated enterprise budgets for vegetable production in West Virginia.

TARGET: At least 50 farmers or ag service providers will request the production schedules and enterprise budgets for use in growing and/or training high tunnel producers to increase their production and profitability.

We were unable to provide production schedules and enterprise budgets for high tunnel vegetable production in West Virginia.

Lessons Learned

Deploying weather stations at the four grower sites made a critical difference in the ability of the growers to monitor their high tunnels during the day to know when conditions were changing requiring their attention with venting since all were manually controlled. The most helpful feature in these weather stations was the app for mobile devices, which allowed them to view this data in real time and setup custom or system alerts so even if they were not on site they could have someone else deal with the venting. Thus, for a cost of \$220 per system, this system is affordable that can be purchased and used by small growers. Our growers did not have any difficulties, but others might have problems if their high tunnel is too far from a structure or there is a structural interference between the sight lines of the Internet Bridge and the weather station or sensors. But for our growers the addition of a weather station was a game changer in their ability to control their environment which meant they were growing their crops in the best environments available.

Requests from agriculture service providers (WVU and WVSU extension, NRCS and others) to help identify growers for this and other projects fell on deaf ears. We were able to find the fourth grower, but in the future, all growers should be identified prior to a grant application.

Staffing challenges delayed work over the course of this project. Employee turnover in the PIs research group continued occurred yearly from 2015-2017 requiring the PI to spend an unexpected amount of time doing the projects as well as managing the staff. In addition, one of the three agriculture professionals involved in this project took a new position in out of state. The second agriculture professional is located over 2 hours away and had an overburdened schedule which did not help with trying to accomplish this project. Even with the hiring of a temporary staff member to assist the main PI the impact of the other technical losses as well as critical colleagues was too great and this project suffered. Recruiting student labor that was reliable proved to be difficult over the course of the project and in other projects. We had students hired during the calendar year, but scheduling them time for them proved to be problematic. In November, 2016, the PI hired a temporary full-time staff member to help on several outreach projects including this project. However, there were more projects than could be handled by this staff member and some projects such as this suffered. In the future, plans should be made to adequately staff for this project. Undertaking a project like this again should have budgeted funds to hire at least a part-time technical staff member to take over the daily tasks of this type of project.

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PROJECT TITLE

Mobile Vegetable Post Harvest Project

Amount Awarded: \$43,231.33

Project Summary

This project focused on the need for shared use equipment to wash root crops (potatoes, sweet potatoes, etc.) in a GHP/GAP audit criteria referenced environment through a collaboration with Potomac State University. The project focused on providing a unit that would provide a GHP/GAP standard environment (particularly post harvest water standards).

Project Approach

Potomac State students were provided with the basic water and post harvest washing criteria for root crops in order to explore the elemental requirements of a mobile unit. With the University, multiple disciplines were utilized to develop a plan and supply list. Students in the general agriculture program worked with procurement as well as the fabrication process. The trailer was purchased (and remains in WVDA inventory post grant) and students worked on implementing the plans. Contributions from welding and other curriculum disciplines made the project multi-disciplined in nature. The students also documented their progress, logged issues encountered and provided visual reference for others to utilize the plans. These are available on demand electronically. After construction, the unit was tested to insure that the plumbing and water system was closed.

Goals and Outcomes Achieved

The project accomplished the goals of building an economical, FSMA compliant mobile washing unit that could be made available in a shared use or aggregation setting. The first unit came in a little over budget but also pointed out serious flaws in the project proposal and its attainability of goals and outcomes.

The unit was made available for public viewing and comment during the 2015 State Fair of West Virginia (due to production delays) and the Potomac State students were able to engage with the public about the project and answer questions. No surveys were administered and no data collected. Anecdotally, visitors were complimentary of the student effort and level of knowledge and interaction. One farmers wanted to use the unit for Farm to School sweet corn processing but was unwilling to make it available to the public requesting a permanent location on his farm to utilize. Without personnel to run, vehicles to transport and access to an

approved water source for long durations, utilization was not possible. The two performance measures were unobtainable. Five specialty crop producers have requested the assemble diagram for the trailer to replicate on their farm.

Beneficiaries

The beneficiaries in the project proposal included specialty crop growers of root crops and a monetary savings by adoption of the developed prototype. It became apparent that the target of 50 growers utilizing the unit was not realistic. Requests for the plans (10 to date) imply a possible beneficiary benefit in terms of construction savings and implementation. The assumption that a corresponding increase in GHP/GAP audits requiring this type of unit was incorrect although the number of audited farms is expanding in the state. An unexpected beneficiary was the students who were involved in the construction who gained valuable educational transference from classroom concepts to practical applicability. When the decision to abandon the project was made, the existing unit and its placement in a permanent location mean that farmer beneficiaries are still obtainable and the life of the constructed unit extended.

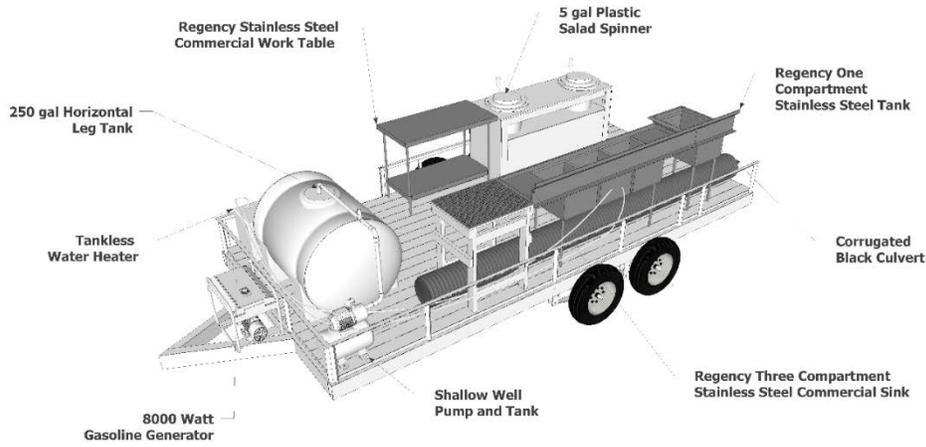
Lessons Learned

Implementation of the FSMA regulations at the farm level compared to the needs of establishing an aggregation or shared use setting for washing functions is complex and must establish a definitive line in terms of processing v. washing. The geographic and infrastructure landscape of West Virginia make the practicality of a mobile unit unrealistic without dedicated staff, approval water sources and grower training/monitoring.

Potomac State University did an excellent job in integrating the project based learning experience throughout the agriculture curriculum. Once envisioned as an introductory agriculture course component, five classes participated in the plan, design and implementation of the project involving over 25 students. Agriculture, mechanics, welding, CAD and others were all classes that participated in these functions. This practical and hands on application of the project serves as a model for future multi-disciplinary course development.

The elements that led to the project abandonment (program administration, personnel, regional aggregation and supply issues, reluctance to transport product due to costs and practicality), point to the need for these types of initiatives being more appropriate for development in the private sector. The organization of the unit and standard meeting at an economic level are all components that can be recycled. Stakeholder input was considered

during project development, however, the identified need did not translate into a willingness to utilize.



NOTE: The built mobile unit is now being housed at the WVDA Food Distribution warehouse for utilization and permanent connection to a municipal water source. Area farmers are invited to explore the unit construction as well as utilize the unit features for root crops and leafy vegetables with the knowledge that GHP/GAP post harvest water standards are maintained and gray water waste is properly disposed.

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PROJECT TITLE

Pecan Production and Demonstration in WV

Amount Awarded: \$14,000.00; Amount Expended: \$14,000.00

Project Summary

Pecans were once a staple of the agricultural landscape in West Virginia, particularly in the Kanawha Valley. Prior to the urban sprawl effects of the greater Charleston area, the areas directly surrounding the Kanawha River were lined with mature and producing pecan trees. This was also the case on the campus of West Virginia State University where the area that currently houses Fleming Hall and the Walker Convocation Center was known as “The Grove” and many students would study under the shade of the mature pecan trees. The agricultural sciences students would also harvest and manage the trees as part of their educational curriculum at the University. This project aimed to bring this living history back to life both at West Virginia State University and also throughout Central and Southern West Virginia.

This project did not build on a previous Specialty Crop Block Grant. WVSU R&D Corporation had received previous Specialty Crop Block Grants, but no grants had focused on pecans or trees specifically. Other grants focused on small fruits, mushrooms, hops, etc.

Project Approach

This project took an approach of developing demonstration and applied research sites with newly planted pecan trees, both at WVSU and also as a collaborative project with the West Virginia National Guard and the Patriot Gardens Initiative. As a result, nearly 100 pecan trees have been planted between both locations, WVSU and Muddlety, with additional trees scheduled to be planted in Spring 2018 due to availability from the supplying nursery. The trees that have been planted have shown a tremendous survival rate and have grown well since planting. The trees planted at WVSU were approximately 2’ in height at planting time in 2015 and have since grown to nearly 6’ in 2017.

In addition to the demonstration and research sites that were developed, educational workshops focused on pecan production were conducted throughout the central and southern counties of West Virginia. These workshops will continue to be offered through the urban and community forestry educational program through WVSU Extension Service and the trees that have been planted will become areas for hands-on training and workshops related to pruning, management, etc. as well as sites for data collection related to pecan production potential in West Virginia.

Goals and Outcomes Achieved

The proposed goals of the project were achieved. Direct Extension-based workshops were delivered to 58 participants, with individual phone calls, in-person discussions, etc. adding an additional 12 participants to the total for 70 total participants that received information as part of the project. In addition to the number of participants, Likert-style evaluations were

completed by 28 participants that indicated that 89% of the participants completing surveys increased their knowledge of pecans and pecan production in West Virginia. The targets for each of these goals were 60 participants and 75% showing an increase in knowledge. One portion of the goals and objectives that has been difficult to track and measure has been in the planting and implementation of pecan trees by participants on their own property. A proper pecan grove takes time, money and effort in planning, preparing the site, etc. and the scope of this 3-year project is probably not enough to find a significant number of new trees that have been planted in excess of the ones planted at the demonstration sites. The success of the demonstration sites will provide insight and additional incentive for new producers to plant pecan trees on site.

Over the next several years, the growth and eventual production data will be collected, at least at a very rudimentary level to determine production potential of individual trees. This information will be valuable when it comes to determining the economic potential and impact of pecan trees for the agricultural economy of West Virginia. Another factor that will help this project in its continuation and growth will be the release of newer cold hardy pecan varieties, as well as the warming effects that have taken place in the last 20 years which is allowing crops that traditionally prefer more southern climates to grow and thrive here in West Virginia.

Beneficiaries

The beneficiaries of the project include landowners, WV Department of Agriculture and others with an interest in pecan, and other specialty crop, production in West Virginia. During the course of the project, each of the beneficiary groups were able to receive information on proper growing techniques, management and maintenance practices, agribusiness management of pecans, crop insurance opportunities through the Farm Service Agency, etc. in order to help move the pecan production enterprises in West Virginia forward in a proper approach. Additional beneficiaries of the project include local and state elected officials through the development of printed materials discussing pecans and other forestry initiatives of WVSU Extension Service, as well as general discussions during legislative days, etc.

A total of 70 West Virginians received direct education on pecan production as a result of this project. This education came through individual discussion, phone calls, etc. as well as large group Extension workshops. In addition to these 70 participants, a partnership with the West Virginia National Guard has allowed for interaction with 7 National Guard members that are working directly with the Patriot Gardens Apple Project as over 50 pecan trees were planted on the same site. Other project beneficiaries include the West Virginia State University Community as 5 new pecan trees were planted on campus as a way to bring back the history of WVSU's campus and "The Grove". With a current student population of over 3,000 and 125 years of alumni, this community is extensive.

In terms of economic opportunities, the trees planted as a result of this project have the potential to produce 30-40 pounds of pecans per year at maturity. Approximate prices for

inshell pecans are \$1-1.50 per pound. This would estimate \$30-60 in revenues per tree. The project planted 90 trees, offering a potential revenue projection of \$2,700-5,400 per year.

Lessons Learned

There were many lessons learned as a result of this project. First, it was quite difficult to attract interest on the side of WVSU student employment and for a while during the project it was a difficult process to hire a student if they were interested. Changes were made internally to remedy the hiring issues for students on the side of Extension, but at that point the project was beyond the timeframe where a student would be beneficial to the project. As a result, the budget was modified and additional trees and other supplies were purchased rather than bringing on a student just for sake of hiring someone. Next, while there is an interest in pecan production throughout the state, the interest is found few and far between with no real concentration of interest in a single location. Central West Virginia, particularly Braxton County, had a strong interest and resulted in nearly 30 people attending a workshop. At the same time, it was difficult to get even 2 people at workshops in the Kanawha Valley. These attendance results show how imperative it is to get good advertising of workshops through all channels like social media, traditional media (i.e. newspaper, TV, etc.), and other advertising channels. Finally, it was noted that there is a huge difference in trees purchased from different locations. For instance, trees from Stark Brothers Nursery were approximately 2' tall at arrival and needed protection from Physical Facilities and the mowing program on campus. However, Green's Feed and Seed worked directly with a nursery in Maryland and the trees were approximately 4-5' tall in 7.5 gallon containers allowing for a more impactful planting.

Contact Person

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Program Income

WVSU Extension Service had no income as a result of the project.

Additional Information

No additional information to come. Photographs will be sent as visual updates in the spring of 2018 and beyond to the West Virginia Department of Agriculture to show growth patterns and general tree health with leaf on rather than dormant season photos.

PROJECT TITLE

**Ritchie County Farmers Market Association Specialty Crop Production
and Market Storage Improvement Project**

Amount Awarded: \$10,000.00

Project Summary

Vegetables and fruits, especially small fruits are in great demand locally. The Ritchie County Farmers Market goal was to fill this niche by helping farmers plant, deliver and store these products more efficiently. Vendor surveys indicate that they would be more willing to plant more foot rows of fruit and vegetables if they had the proper implements to make it less time consuming. We purchased a bed shaper/mulch layer, transplanter, and mulch lifter and a portable cooling trailer for the vendors to use as a cooperative. Each implement would be rented with a fee to the members of the Ritchie County Farmers Market Association and available to use for farmers outside of the association. The portable cooling unit is used to hold produce at the market to ensure the highest quality for the consumer. Currently the market does not have access to electricity so a team has developed a design to build a cooler that will run off a generator. To date three other producers have replicated the design and built their own.

The bed shaper and mulch layer has been used consistently by one producer and demonstrated at a college and another producer.

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

Project Approach

After the initial survey that was used to determine the need for the machinery the vendors continued to look for educational opportunities. This project will increase the amounts of fruits and vegetable produced locally with higher profits staying on the farms it will provide farmers the opportunity to enjoy shared implements that will run farms more efficiently. To increase vendors and to encourage current vendors to adopt the new practice we held a demonstration at WVUP June 2015 and September 2015. Two vendors really amped up their production.

Another program was offered spring 2017.

Several Growers have utilized the equipment and were able to estimate to increase their volume and productivity by \$5000. One grower is now sending her product to the cannery to even have a value added product.

Goals and Outcomes Achieved

Goals

- 1) Increase small fruit and other specialty crop production in WV ie Ritchie County.
- 2) Maintain high quality specialty crops at WV Farmers Markets and Farm to School programs.

a. Objectives

- A) Vendors in Ritchie County and surrounding areas will increase their capacity for specialty crop production by planting more foot rows of produce more efficiently.

- Two vendors are have doubled their tomato production as a result of this grant and the equipment. One vendor planted 2500 tomato plants last year and the other has been recognized by the NRCS for her work in the high tunnel that was greatly shaped by the RCFMA and this project.
- Two producer doubled production and there has been a lot of interest in the production tools. Since coordinator left I am unsure on the amount of producers that have used the tools to increase production. There were several inquiries about the tools before the coordinator left. One of the problems that made them less useful is the producers of Ritchie County Lacked the Tractor size needed to run the bed shaper. The producers that were successful in using the tools did help increase production with them as well as others because people were able to see that it can be done. Several producers have moved from producing not only at the farmers market but have successful CSA's as well as farm stands.

B) One on farm and one classroom workshops in conjunction with the WVU Extension Service were held to promote planting of small fruits and vegetables in which site prep, cultivar selection, planting, trellising, maintenance and pruning, propagation, pest and disease management, harvesting, and marketing will be discussed. Two workshops on how to use the bed shaper/ plastic mulch layer, mulch lifter and transplanter how they can increase production of a wide variety of specialty crops.

C) A 5'x10' refrigerated mobile trailer will be built using insulation, a 15,000 BTU RV air conditioning unit, a coolbot controller, and 4000 watt gas generator. This trailer will be used at the Ritchie County Farmers Market to maintain fruits and vegetables at temperature during summer markets. Local health department's requirements state that meats and produce are not permitted to share a cooling unit. This trailer will be available for use to or produce vendors only.

The Coolbot trailer was discusses at the SFC by WVU-P students but was unable to be there in 2016. Since then it, as well as the bed shaper, has been in the local county newsletter and shared at the farmers market. I believe the tools could have been better utilized with more classes and workshops. Unfortunately when the survey went out there was much interest. Consumers wanted produce, especially, fruits. Surveyed producers wanted tools to make it easier. Unfortunately with lack of leadership the project was unable to offer the outreach and education that they had hoped.

Measurable Outcomes

Evaluations: Three producer built their own coolbot trailer, two double production with the use of the much layer/lifter, and one added another high tunnel.

– Agents comments: Workshops were not as attended as I would have liked to see, but I think that timing greatly affected this. Many producer would love to use the machinery but did not have the tractor required to run it.

Beneficiaries

- Ritchie County Farmers Market Association
- Ritchie County consumers
- Ritchie County Producers
- Students at WVUP

Before the project manager was reassigned, two producers were using the bed shapers and had doubled productivity as well as increase profit on the farm. One vendor is planning on opening her own road side stand as well as further processing her produce. Customers at the farmers market will also benefit from the increased produce as well as the higher quality from the cooling unit.

The workshops that were help showed producer knowledge gained on the bed shaper and cool bot trailer. Many producers did not know what it was before attending the workshop.

2017 season the cool bot trailer was not utilize at each market. Student labor was going to be utilized to finish the trailer and the original coordinator left. Second project lead was unable to utilize the students.

2017- three producers went on to build their own cool bot. One still uses the market, one moved and sold their unit and the other uses it at their home.

Total of 27 attendees in the two workshops, 4 went on to either use the bed shaper or invest in their own cool bot unit. Potential economic impact was with the increase if 2500 tomato plants on one farm that was a potential of \$5000 made. Producer was unwilling to share her profit numbers.

2018- one vendor is sending product to the cannery to add a value added product to the market utilizing the seconds from her tomato crop. This was a result from having more product due to the use of the bed shaper and plastic layer.

Lessons Learned

We have learned many things during this project. In the course of three years our Farmers Market President moved. Three of our largest vendors left to start their own CSA's and were not able to help as much as I hoped and I, The Extension Agent, moved to a new position in the eastern panhandle.

- Don't try to have workshops in the spring, farmers are too busy to come out and learn. This made it hard because during the time of year when we would have had a good turnout we could not go outside to demo equipment. We did have a winter vendor meeting and watch accredited videos which seemed to excite the vendors about the upcoming year.
- Most of Ritchie County producers do not own a tractor. This made using the equipment impossible

- The CoolBot trailer was super popular. We were only permitted to use it to store fruits and vegetables but seeing it inspired several producers to build their own so they could store what they wanted in it.

Contact Person

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Program Income

No program income. Two producers doubled production but were unable to provide me with monetary figures.

PROJECT TITLE
SAGE II Perennial Produce
Amount Awarded: \$16,000.00

Project Summary

When this grant was awarded, the Sustainable Agriculture Entrepreneurs II, or SAGE II, was in its second year of an economic development initiative to teach people how to grow food and turn it into an economic opportunity. In addition to annual sustainable vegetable production SAGE II's intent was to add perennial crops to enhance and sustain production over time. Compared to annual crops, perennial vegetable and fruit crops would provide more food throughout the year, be easier to grow, were ecologically beneficial and less dependent on water.

This Perennial Produce project was an original funding from SCBGP and did not build upon a previously funded projects through SCBGP or SCCBGP-FB.

The SAGE II chose to explore growing asparagus, strawberries, artichoke, and horseradish at different urban sites in Charleston, WV.

The SAGE II team utilized the professional expertise of the SAGE Program Manager and SAGE Program Farm Manager, to provide guidance as the project started up. Both program managers relocated out-of-state during the first year of the project. SAGE II team members then assumed roles as managers for the SAGE program. Although this was valuable by allowing community members the opportunity to participate in the SAGE program, it left the SAGE II team shorthanded. This resulted in a delay for many of the activities in the Perennial Produce project. By the beginning of the second year of the project the SAGE II team decided to defer the SAGE community education program and focus on the Perennial Produce project.

In years two and three of this project the SAGE II teams solidified sustainable sites, completed build outs, planted, tended and began selling the perennial produce. There were many lessons learned which are shared in the appropriate sections below. Based on those lessons, SAGE II expects the upcoming production and harvest season to be strong, the education and awareness of these products in the community to be on-going, and the farmers to continue to learn from their experiences with the perennials as the years go by.

Project Approach

The SAGE II approach was to utilize professional, community and volunteer resources to educate themselves and their community of consumers, select sites, select varieties, build raised beds, and grow and sell perennial produce.

Educate: SAGE II relied upon the expertise of the SAGE professional staff and program mentors and supporters to develop the program. Additionally, in conjunction with WVU Extension Service, classes were delivered to SAGE students and graduates on "Varietal Selection and Post-Harvest Handling", presented by Dr. Lewis Jett, and to the public on "Perennials in the Veggie

Garden” presented by John Porter. Most SAGE II participants attended the Small Farms Conference in Charleston. Hands on growing experience provided invaluable lessons to all the growers and resulted in modified practices for the final year of this project.

Sites:

In the initial year of the grant, four urban sites were identified for growing perennials with one more to be identified in the second year. Two of the initial sites were the SAGE urban farm locations at Ohio Avenue and Rebecca Streets on the West side of Charleston. The other two were identified by WVSU Extension Service. They were the Keep Your Faith Corporation on the West Side and Carrol Terrace on the East End. The fifth site was identified in year two and is known as WV Fresh on the East End.

Both the Ohio Avenue site and Carrol Terrace discontinued participation in the program in the second year. The Ohio Avenue site had been primarily manned by SAGE students. Without a class of students, the site was difficult to manage. Additionally, the site suffered a few damaging vandalism events. Then, when the farm manager relocated out of the area and was no longer able to provide the management needed to keep the farm operational, SAGE II chose to release the site back to the property’s landlord. Staff turnover at the WVSU Extension Service resulted in a disruption in participation at the Carrol Terrace location.

The remaining three sites continue to be actively engaged for growing all varieties of the four perennial products.

Select Varieties:

The SAGE II participants selected four crops to grow based on the personal preference and desire to grow, likelihood of success based on climate and conditions, and perceived opportunity for sales. Varieties were selected based on Dr. Jett’s varietal recommendations as well as interest and curiosity. Six varieties of strawberries were selected, along with two varieties of asparagus, three varieties of artichokes and one variety of horseradish. Plants were first planted in year two with additional plantings in year three. The varieties were:

- Strawberries:
 - Earliglow, AllStar, Tribute, Jewel, Seascape, White Carolina Pineberry
- Artichokes:
 - Green Globe, Imperial Star, Purple
- Asparagus:
 - Mary Washington, Purple
- Horseradish:
 - Bohemian Marliner Kren

Build:

Buildouts were started at the end of the first year and mostly completed in the second year, with additional beds added for expansion in the third year. SAGE II members along with SAGE classes, family members and other members of the community helped with building and filling the beds.

Grow and Sell:

The initial crop planting occurred during the second year of the project. In the third year additional crops were planted based on growers' request for expansion or replenishment where the initial crops had failed.

- **Strawberries:** All varieties grew well except for the White Carolina Pineberry and Seascape strawberries which proved to be less disease resistant. The leaves of strawberries were damaged by grazing deer during mid to late summer at the Rebecca Street location. Chicken wire was placed over the strawberries to deter deer through the fall and winter, and bird netting was added in the spring.
The market for fresh strawberries is very good and is sustainable throughout the harvest season.
- **Artichokes:** The artichokes were somewhat prolific considering it was their first year of planting, however most were winter-killed. A second planting was made in year three with the intention of covering them during the winter and tending to their needs. For a seasonal urban farmer, attending to artichokes during the winter at an off-site farm may be somewhat detrimental to the ease of growth.
The children at Keep Your Faith enjoyed learning about artichokes and, for many, tasted them for the first time. They were enthusiastic about the shape and flavor and will enjoy selling them and sharing them with their families. Artichokes are marketable at farmer's markets and, in certain circumstances, to restaurants.
- **Asparagus:** Both varieties were available in year three. Although the asparagus was delicious, the farmer's market was not open early in the spring when the harvest was ready. Only a small amount of harvest was ready at any given time so selling to restaurants was not a good alternative.
Unless the asparagus is more prolific in future years in the allotted space it is has been given, it may not be the best option for a small urban farm looking to sell through seasonal markets or restaurants.
- **Horseradish:** Only one farmer reported planting horseradish and he had not yet harvested any of the root. The grower who was most enthusiastic about selecting horseradish was no longer a part of the program due to a change in employment. All three of the current participating locations are growing horseradish this year, are interested in its production and anticipate harvest. However, the market for horseradish is expected to be very niche.

All perennial produce growers continue to evolve through iterative adjustments to their practices and market experiences.

Goals and Outcomes Achieved

Goal: The program aimed to determine which varieties grow the best as well as what conditions produce the best produce for use at market. Varieties were to be evaluated on ease of planting and tending, amount of produce produced, ease of sale at market, and market value. The ultimate goal was to have 1-2 varieties of each crop which are deemed successful for use in urban, nontraditional environments.

Outcome: Although SAGE II was successful in initially identifying which varieties of perennials grow best in the Charleston urban farm environment, additional years of growing may further identify those that are more resilient as they are exposed to different conditions through upcoming years.

Strawberries: Of the six varieties tested, four varieties thrived. However, they must be protected by four legged wildlife as well as birds. They are relatively maintenance free in the winter. They are extremely easy to sell, provide a very good market value, and are available during market season.

Artichokes: All three varieties grew well however they did not withstand the winter. The growers will be covering the artichokes this winter to determine their ability to survive without being relocated to a high-tunnel or green house. If they are unable to survive the winter without being relocated, then only locations with temperature controlled environments will be appropriate for artichokes. This does not fit the footprint of most small urban, nontraditional environments. However, if the artichokes survive with the simple addition of row cover, then they will continue to be grown. When well presented, they are fairly easy to sell and provide a fair market price.

Asparagus: Both varieties grew well however the yield per square foot may rule them out as good market crops for small urban areas. The upcoming two years should provide a better harvest, but, again, time will tell. Because they are early harvest crops and local farmer's market are not traditionally open during early spring, the market is not a good outlet. If enough volume is available at harvest time, restaurants or alternative markets such as consignment can be considered. Consumers assure that fresh locally grown asparagus is in high demand.

Horseradish: Only one variety of horseradish was available through suppliers. Growers are focusing on this crop to determine its capability to withstand winters without row cover and to identify markets. Demonstrations on its use will help educate consumers and may drive demand.

Goal:

SAGE participants will show an increase in knowledge of specialty perennial crops.
Consumers will show an increase in appreciation and buying of specialty perennial crops.

Outcome:

All SAGE and SAGE II participants and perennial produce growers gained knowledge from growing perennial crops. Aside from classes and hands-on experience, growing guides were provided. Each grower experience something that caught them by surprise, and, as is the way in farming, each crop teaches its grower what it needs to survive and thrive.

All crops taken to market were quickly purchased by consumers. The children of the Keep Your Faith organization learned to appreciate vegetables they had never tasted and shared the experience with their families.

Survey Results:

Before and After the SAGEII Specialty Crop Grant program

How would you rate your level of **knowledge** about growing each specialty crop?

1) no knowledge, 2) some familiarity, 3) fair understanding, 4) good understanding, 5) high level of knowledge

	Before	After
Strawberries	2.2	4
Artichoke	1	3
Asparagus	1.4	3.4
Horseradish	1.4	2.8

How would you rate your level of **experience growing** each specialty crop?

1) never grown and not exposed to growing, 2) not responsible for growing, but exposed to growing (family farm etc.), 3) grown for at least one season, 4) 2 seasons of growing, 5) 3 or more seasons of growing.

	Before	After
Strawberries	2.2	4
Artichoke	1.2	2.8
Asparagus	1.2	3.4
Horseradish	1.4	3

How would you rate your level of experience **selling** each specialty crop?

1) never sold and not exposed to selling, 2) not responsible for selling, but exposed to selling (family farm, farmer’s market etc), 3) sold for at least one season, 4) 2 seasons of selling, 5) 3 or more seasons of selling.

	Before	After
Strawberries	2.2	3.4
Artichoke	1	2.25
Asparagus	1.6	3.25
Horseradish	1.2	2.4

At the conclusion of this grant program:

Which products have you been most successful growing and selling? Order them 1 to 4 with 1 being the most successful and 4 being the least successful. If you did not grow a product, mark with n/a.

	Growing	Selling
Strawberries	1	1
Artichoke	4	4
Asparagus	3	2
Horseradish	2	3

On a scale of 1 – 5 with 1 being the least helpful and 5 being the most helpful, how would you rate this specialty crop program been in providing you with the resources and education needed to grow and sell these crops?

1 Not helpful..... Very Helpful 5

Total score: **4.8**

Market Customers and Consumers

One a scale of 1 – 5, what is your willingness to consume the following:

	Prior to product selling	After product availability
Strawberries	5	5
Artichoke	1	2
Asparagus	3.7	4.7
Horseradish	1.6	3

Beneficiaries

The initial beneficiaries of this project have been the SAGE Class and the growers of in this Perennial Project. They are maturing in their knowledge and abilities to grow the perennials, finding markets for the products and in one case, experimenting with added value products. Secondary to this, students and their families, whether they are tending to raised beds, selling produce at their school’s farmers market, or consuming new foods they have never experienced, are benefitting. Finally, farmer’s market shoppers can purchase high quality, fresh, delectable perennials. Between the growers, the students and their families, and the shoppers, the estimated total number of beneficiaries affected by the project’s accomplishments is 500.

Lessons Learned

About the produce:

Strawberries:

- Everyone loves them, and you can sell as much as you can grow.
- Strawberry plants provide delicate leaves that deer find appetizing in the late summer.
- Strawberry varieties, planted closely together as is often the case in urban raised beds, are difficult to differentiate from each other when the runners take off.

Asparagus:

- Initially, yield per square foot will not be efficient in a small space.
- Harvest is during off-season for seasonal farmer's markets.
- Small urban farms may not be the right size to supply markets.

Artichokes:

- They need protection in the winter to survive.

Horseradish:

- Growers were not as excited about this product initially as the others. But curiosity and commitment are moving them forward.
- Like herbs, horseradish is likely to be a slow mover at farmer's markets.
- This is a niche market product.
- Demand may be driven through demonstrations and after market products.

About the soil:

Soil in raised beds needs to be replenished and supplemented as it settles from year to year. With perennials, this is slightly more challenging than with annual crops. Plan for it.

About the children:

Children are enthusiastic consumers. They are happy to grow food, love to eat the food they grow, and are proud to sell the food they grow.

About the Farm Site.

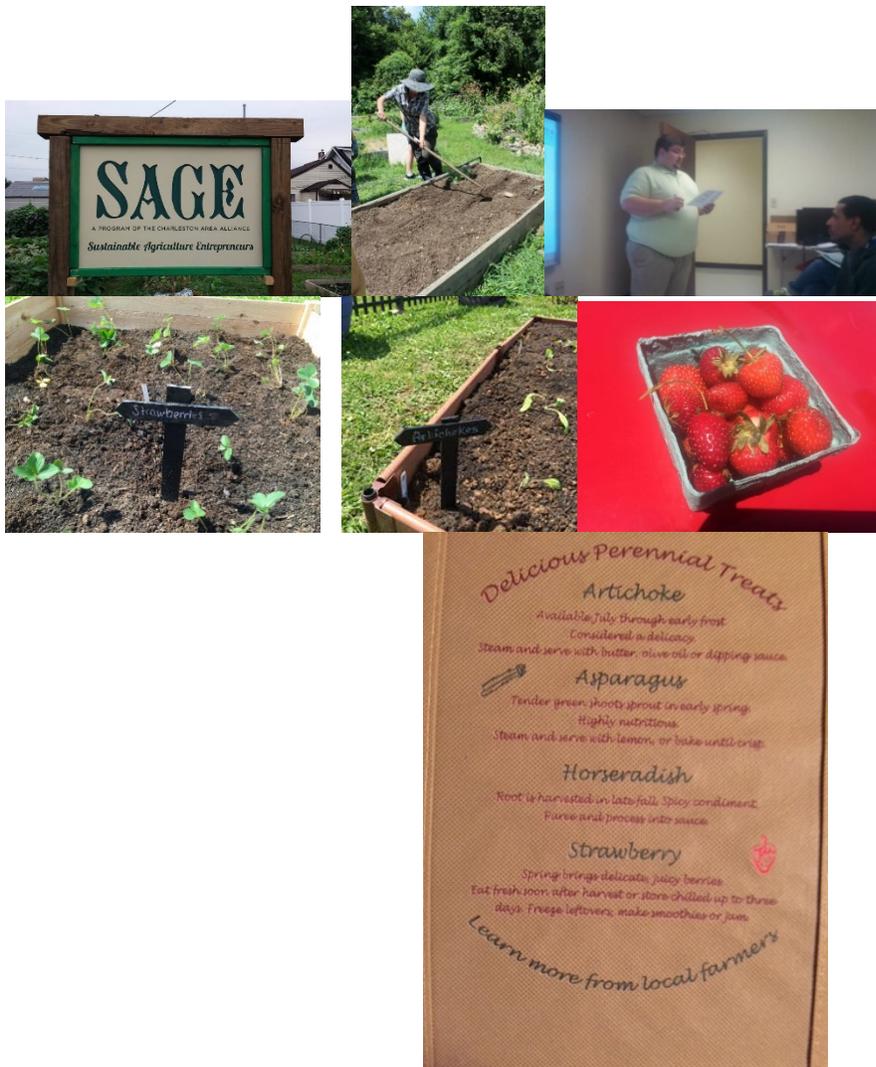
Be especially careful about site selection when choosing to farm in an urban setting. If the farm is unattended (you or someone else associated with the farm doesn't live there) or is in a high traffic area, you can expect a certain amount of pilfering. The more desirable your crop, the more likely pilfering will occur. Strawberries for example, are not only irresistible for deer and birds, but for curious neighbors or visitors as well. If your farm is in an area where there is a vagrant population or high crime rate, you may experience property damage or safety issues.

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Additional Information



PROJECT TITLE

Techniques for Increasing the Supply of Fresh, Locally Grown Produce in the Tygarts Valley District

Amount Awarded: \$12,000.00; Amount Expended: \$10,584.99

Summary

The project was to increase production via season extension techniques with low tunnels and use of a bed shaper, water wheel planter, and mulch lifter. There was also an education component to provide GAP training, a Food Safety course, and education materials on season extension for Vo Ag Students. Although geographically challenges, a surge in local food interest, limited supply of off season product and a need for some basic equipment that could be cooperatively shared were the elements that provided the foundation for this project. Increased row feet of production and the ability to supply several existing local markets provided the incentive for project participation. Though limited in scope (number of farmers), the project was designed to demonstrate the effectiveness of the education, mentorship, shared equipment and production increase continuum.

This project was a new initiative to the region and was not part of a previously funded project.

Approach

The Extension Agent for Tucker County was a key partner in this grant application. Unfortunately, that person moved on to another position just as the program was ramping up. We also had some technical advice from the state Horticulturist.

The Taste of Tucker Farmer's market was one of the key partners, however, a local grocery that is supported by grant funding unofficially declared war on the our market and virtually destroyed it during the grant period.

We did however have great response from the students at Tucker County High School regarding GAP Training and writing a food safety plan.

The mulch lifter, mulch layer, water wheel planter, and low tunnel supplies were all purchased and put in use.

Unfortunately, we lost our technical advisor during the grant period and were not able to get the above workshops organized. We did, however, substitute a writing a food safety plan workshop which was attended by agriculture professionals, farmers, and students.

The GAP training was held and attended by a mix of extension staff, WV Department of Agriculture staff, farmers, students and Vo Ag teachers.

Goals & Objectives

We were able to get people including the Vo Ag teacher, Assistant Principal, students from Tucker County High School, farmers from Tucker, Hardy, Tucker County Extension Staff and

some WV Department of Agriculture staff GAP trained. We also had students, the Vo Ag teacher and community members trained on writing a food safety plan.

The Equipment was purchased and has been used. I'm getting feedback from some of the participants that at least the water wheel planter and the mulch lifter will be used more in future seasons.

We placed row 500 feet of low tunnels. The 2014 report showed 5 farmers reporting a total of 11,000 row feet. In 2015, the number of farms dropped to 4 and the row feet increased to 13,600. In 2016, the number of farms dropped to 3 since one of the farms lost his field crops and high tunnel to flooding, but the row feet increased to 19,200 feet.

We were also able to cut in half the amount of time it took to remove plastic mulch from a garden.

Presentations were made to the Tygart Valley Growers Association, the Taste of Tucker Farmer's Market, and the Vo Ag teacher at Tucker County High School regarding the availability of the equipment.

A questionnaire was administered to gather data provided above about number of farmers and row feet gained by this project. The small number of participants was disappointing, however, the increase in row feet demonstrated the effectiveness of an investment in shared equipment as well as technical assistance linkage provided some project effectiveness.

The increase from 2015 over 2014 was 24%. The increase from 2016 over 2015 was 75%.

The number of farmers using season extension techniques increased from 3 in 2014 to 5 in 2015 which was an increase of 67%.

With the increase in row feet, training, education and mentorships, growers are able to supply locations like the Highland Market, Front Street Grocers, and the Barbour County Garden Market earlier in the spring and later in the fall accomplishing supply and availability goals.

Two growers from the project, a grower from the Taste of Tucker Farmer's Market and one Vo Ag student from Tucker county High School joined the Farm to School programs in Tucker and Barbour counties for a total of 13 vendors involved in 2015. Some of these growers are not part of the reporting cohort of this grant, however, increased participation and supply were motivated by the activities of this project.

Beneficiaries

Tucker County High School Vo Ag program. The Wardensville Farmer's Market, Stewart Farm, Sickler Farm, The Hinkle Farm, LLC., Sikarskie Farm, and Spencer Apiary.

The Taste of Tucker Friday evening farmers market increased from an average of 4 farmer vendors to a high of 16 farmer vendors . The community impact was approximately 3,000 persons.

Lessons Learned

Some of the farmers quit growing from the grant application to the implementation. We were able to replace them with other growers. We were surprised at the limited interest in trying new things. The use of low tunnels was more interesting to people than the access to the equipment. However, the Sickler Farm is going to utilize the waterwheel planter to significantly increase their strawberry production.

Even with the increased efficiency of removing plastic mulch it was still a ton of work and a great amount of waste. Some of our growers are returning to traditional cultivation methods and becoming more selective of when to use plastic mulches.

Contact

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Additional Information

There was no program income.

PROJECT TITLE

Vineyard Hills Orchard

Amount Awarded: \$25,000.00; Amount Expended: \$24,873.75

Project Summary

Through an innovative land use partnership, Grow Ohio Valley’s Vineyard Hills Orchard has transformed a highly visible abandoned urban space into a fertile orchard. With 220 trees planted, and another 400 awaiting planting, the orchard’s output will fill a gaping hole in unsatisfied demand for local fresh fruits. It has become a commercial-scale urban specialty-crop production center, which promises to be an invaluable venue for vocational skills and farm training.

This project is a *new project*; it does not build on a previously funded project with the Specialty Crops Block Grant program.

Project Approach

Prior to the establishment of the Vineyard Hills Orchard, there were no commercial apple producers in the West Virginia’s Northern Panhandle. The nutrition director for the Ohio County school district has repeatedly expressed interest to purchase local apples for students in her district, but has been unable to find a consistent, reliable supplier. The same is true for other school districts in the region.

Meanwhile, in Wheeling’s urban core, there are many eye-sore, barren vacant lots, with no contemplated uses. These lands can be remediated for specialty crop production and become productive resources. This project will stimulate specialty crop production in the region *and* provide a productive use for unused vacant lots.

This project is important in that:

1. It has demonstrated how urban brown-fields can be converted into productive resources for specialty crop production.
2. There is substantial unmet demand for apple crops in Wheeling and the Upper Ohio Valley at-large.
3. It will provide a critical specialty-crop production training venue in the Upper Ohio Valley.
4. About 3-acres of land, owned by the Wheeling Housing Authority, have been made available to GrowOV for this project.

The following objectives were accomplished:

1. Established a commercial-scale orchard that can make direct sales to adjoining school districts to source student meals with locally produced specialty crops.
2. Created a venue to conduct workshops and seminars on soil remediation and

apple growing.

3. Increased awareness about the importance of specialty crops, and the opportunities that are inherent in producing specialty crops on vacant land.
4. Completed soil testing and developed an active fertility remediation plan vetted by experts.

Completed work at Vineyard Hills Orchard includes:

- **Implemented soil remediation plan**
 - **Tested soil quality:** Soil chemistry testing was completed at the grow site. Specifically tests were conducted to analyze high calcium levels in soil. Original Mehlich-3 tests were inconclusive regarding calcium saturation, and thus ammonium-acetate tests were conducted to isolate free calcium, and thus provide test results with practical implications. Results, analyzed in consultation with WVU extension resources, revealed that calcium saturation is indeed higher than usual, as is soil pH. High calcium and pH levels are most likely the result of previous masonry/concrete structures on the property, as well as a native Ordovician clay soil.
 - **Developed and implemented updated soil remediation plan:** As a result of soil test results, soil remediation plans were adjusted to include application of peat moss (to decrease pH and increase organic matter) at time of planting in each tree hole. Furthermore, high calcium levels indicate poor returns on typical phosphorous application. As such, our phosphate application strategy included rock phosphate in combination with organic matter (leaf mold and compost) at time of planting, as well as application of rock phosphate in “shallow wells”, small holes filled with phosphates that remain immune to calcium tie-up and accessible to tree roots. All trees also received at time of planting:
 - Mycorrhizal inoculant, to establish beneficial fungal colonies
 - Kelp meal, to provide micro-nutrients and reduce transplant shock
 - Vermiculite, to facilitate ease of amendment mixing, and to buffer soil moisture.
- **Completed site preparations:**
 - **Completed excavation:** The site was excavated to accomplish three objectives; 1) bench terrace across property for easy vehicle access, 2) vehicle access on and off the site, and 3) vehicle and tool access from our Grandview building to the site (a distance less than 1/8th mile). Each of these objectives was accomplished. The orchard site is on a 20-25%

grade, making much of the orchard inaccessible to limited-mobility members of the community. As such, our single bench terrace, and adjacent plantings, will be more easily accessed by participants who can access trees from flat ground. This will also facilitate tours and workshops, providing significant orchard space that is suitable for crowds and comfortable movement. The orchard site consists of two levels, separated by an unnavigable steep grade. As such, two separate vehicle access points were established. We excavated to create an access road from our food-aggregation building by removing a collapsed dilapidated building, and spreading gravel on that road. On the lower level, we removed a curb, and re-configured a pre-existing drainage swale to allow for vehicle access from the adjacent road.

- **Gained right of way:** To access the upper section of the lot required us to obtain a right-of-way from a separate property owner. This right of way was granted on a no-cost, into-perpetuity basis.
- **Removed existing trees:** removed 5 mature trees and assorted brush from site to clear way for apple trees.
- **Excavated basin terraces:** accomplished by augering tree holes (2' auger), and allowing natural shedding of removed soil to fall downhill, creating a small "basin terrace" around each tree of roughly 3' diameter. This allows each tree to sit in a flat "pad" on the hillside for improved nutrient and water retention, while avoiding pitfalls of extensive excavation (expense, and risk of hillside slippage).
- **Installed irrigation system:** Connected to municipal source, and ran underground irrigation lines to all major orchard blocks, with a final inventory of 5 hose bibbs and 13 drip-line risers. This afforded us easy access to water at time of planting, and will provide convenient drip irrigation for trees as they mature and bear fruit.
- **Installed fence:** ¼-mile long perimeter fence with the following properties:
 - 7.5' height
 - Treated wood posts
 - Galvanized steel drive-thru gate (12' width) and wood man-gate.
 - Plastic deer net, supplemented with 4 high-tensile wires connected to a fence charger (electric fence)
 - Secondary high tensile wire installed 2' out from the exterior of the fence, on an angle, to provide 3-dimensional fencing for improved deer deterrence.

- **Established orchard**
 - **Selected rootstocks:** In conjunction with orchard specialists, we came to the following decisions:
 - Use Geneva rootstocks: increased resistance to tree diseases over Malling rootstocks, and increased tolerance to native clay soils.
 - Plant a mix of dwarf, semi-dwarf, and full-size rootstocks to realize the known benefits of all three, and provide a case-study for other growers (and our future selves) to allow for intelligent decision-making in our community around orchard systems.
 - Plant some rootstock as plain rootstock (not grafted) to allow for year of root establishment before grafting, and to allow for heirloom and rare apple varietal grafting.
 - Plant most (95%) initial trees pre-grafted to show productive output earlier and diversify risk.
 - Plant 210 rootstocks in orchard nursery, for future grafting and subsequent tree plantings.
 - **Established nursery**
 - Created 3 fertile growing beds, each 100' long, to hold 210 rootstocks.
 - Grafted all 210 rootstocks to commercially viable scion varieties, for field-planting in 2019.
 - **Planted 220 trees, with more to come:** In spring of 2017, 220 trees were planted, all on Geneva rootstocks with commercially and locally appropriate scion varieties. Another 130 pre-grafted trees are ordered for planting upon spring thaw in 2018. Combined with the 210 self-grafted trees that will be field planted in 2019, a combined total of 560 trees have been procured for the Vineyard Hills Orchard.
 - **Experienced exceptional tree survival rates:** The nursery that provided most of our trees (Cummins Nursery in NY) cautioned us to expect 80-85% tree survival rate in year 1, based on their decades of experience with commercial orchards. As of October 31, we have lost 2 of 210 total trees, for a tree survival rate of 99%+.

Sustainability and the Future

Through the course of this project, several roadblocks were identified and overcome as described below. Each triggered revisions to the original project workplan and timeline (as recorded in both Annual Reports).

- **Hillside instability:** Analysis revealed geological and soil instability on the orchard site (hillside), requiring expert consultation on excavation and drainage prior to work commencing. This resulted in a recommendation *against the extensive terracing* called for in our original plan. The hillside is prone to slips and instability, and a *minimal* amount of excavation was recommended. This resulted in a workplan calling for minimal “basin terraces” – small passive terraces at each individual tree.
- **Cicada emergence:** Emergence of “Cicada Brood V” (early summer 2016). The cicadas had potential to be very damaging to young trees, which resulted in delaying the first round of tree planting to spring of 2017.
- **Poor soil condition for blueberries:** High pH and high calcium levels prohibit the planting of acid-loving blueberries, resulting in a change to workplan: *no blueberries*.
- **Delays in other projects:** The initial year of the grant period was very busy, as GrowOV initiated several projects aimed at promoting specialty crops in the Ohio Valley. Namely, we built two greenhouses, launched a six-day-per-week mobile farmers market aimed at addressing food access issues, and expanded our vegetable production by 250%+. Due to weather and unexpected staff turnover, several of these projects were delayed and faced challenges that consumed staff resources. This resulted in a reallocation of staff time to the orchard to ensure focused completion, as well as a budget modification to allow for personnel expenses.
- **Deer invasion:** In July 2017, deer entered the orchard through a gate left open. In 24 hours, deer consumed ~50% of all tree leaves in the orchard. In response, we added gate locks (to prevent unplanned visitors from leaving the gates open), and added a secondary top-wire to the fence, standing out 2’ on the exterior of the existing fence, to create a 3-dimensional fence for improved deer deterrence. All trees have rebounded and are healthy headed into winter 2017.

6. Goals and Outcomes Achieved

Three intermediate goals were set at the outset of the project:

- a) *Create a fertile, well-considered and healthy orchard with apple trees, brambles and blueberry crops planted.*

Implementation: As noted above, blueberries were eliminated from the production plan due to unfavorable soil conditions. Otherwise, this goal was accomplished.

Discussion of performance measures: We did not pursue a ranking system for orchard design and implementation. We developed close relationships with expert orchardists, and found the ranking system to be unwieldy in terms of time commitment from

otherwise busy mentors/advisors. Instead, we relied on specific advice as relates to all phases of orchard design and implementation.

b) *Capture the interests of would-be and potential future-farmers to consider specialty-crop production.*

Implementation and discussion of performance measures:

- In 2017, GrowOV launched a 17 member AmeriCorps program, training and employing young adults from all over the country (including local young adults). Of these AmeriCorps members, 5 spent significant time in the orchard, and have come away with vastly enhanced knowledge of specialty crop production. At least one of said service-volunteers plans to return to his family farm in 2018 to engage specialty crop production, largely as a result – and with training – from his time spent at Grow Ohio Valley. Another member plans to travel to Africa with the Peace Corps to employ his newfound specialty crop knowledge to enhancing vegetable production systems in rural villages.
- GrowOV hosted 3 workdays, open to the community, during 2017. All 3 workdays afforded participants the opportunity to learn about specialty crop production, while contributing to orchard development. One attendant left empowered and determined to plant apple trees on his family farm, and plans to share bulk-purchasing power with GrowOV on our 2018 tree order. These community volunteer workdays have resulted in 200+ hours of volunteer service at the orchard.
- In 2017, GrowOV launched “Project Worm”, a program designed to provide meaningful activity and engagement to adults with developmental disabilities. Participants accomplished several “micro-projects” within the orchard, establishing plant species that attract beneficial pollinators and insect predators into the orchard.
- In fall 2017, a surprise development paved the way for a new partnership with local youths. Ohio County’s “alternative school” is the destination for kids who are not succeeding in the public school system (behaviorally and academically). This fall, its teachers approached GrowOV requesting meaningful urban farm experience for their at-risk teenage students. We hosted the students on a series of site visits, including the orchard. We suspect that this will grow into a more formalized relationship, with local at-risk teens regularly working and learning in the orchard.
- As the orchard approaches harvest over the next 3 years, we plan to sharpen our focus on community workshops and training opportunities, working towards

the long term goal of enhanced specialty crop production in the Ohio Valley.

- c) *Maintain and grow enthusiasm of regional school officials and students to purchase locally produced specialty-crop snack foods, namely apples and berries.*

Implementation and discussion of performance measures:

- We have received strong verbal interest from child nutrition directors in Brooke and Ohio Counties to purchase locally grown specialty crops, especially apples.
- We have not received formalized indications of interest, as our apple orchard will not be productive for another 3 years. We plan to pursue formalized commitments in subsequent years.
- We have not yet received formalized volunteer visits from local school students. We plan to do so in coming years, as we develop the orchard into a space that is more readily accessible to diverse age groups.

Project Sustainability-The Future:

- **Workshops** – We anticipate hosting 20+ backyard/hobbyist specialty crop producers at our workshops and workdays over the coming 3 years. We plan to host 20+ market producers and 50+ hobbyist producers throughout the entirety over the next 10 years, with our focus on workshops increasing as trees approach maturity. *Frankly, workshops make more sense several years in the future.* Our young orchard, with its not-yet-productive trees, limited site accessibility, and raw-beginner orchardists, doesn't paint the most inspiring nor informative picture for would-be producers. For context: we have not yet gone through a round of pruning (our trees have not passed through their first winter).
 - In each of the next 4 years, we anticipate making substantial plantings at the orchard, establishing new orchard blocks. Those plantings will be made in the context of a maturing orchard, where harvest, canopy management, irrigation, pest management, and all aspects of orchard care will be fully active. What's more, our team's knowledge and capacity to share information will grow substantially as we move past the raw-beginner stage. As such, we anticipate an invigorated focus on education and training opportunities in our orchard over the next 4 years.
- **School visits and FFA/4H visits** – Similarly to workshops, we see the potential for meaningful youth visits to take shape over the next 4 years, as we make site accessibility improvements and –ultimately – have apples to share with the kids. We are especially emphasizing poison ivy eradication before introducing large numbers of schoolchildren

on site (poison ivy is ubiquitous in the orchard). We anticipate 200+ school students visiting, with volunteer partnerships taking shape.

- **Obtain formalized interest from public schools** – Over the years of this project, multiple discussions took place between the Ohio and Brooke County Schools nutrition directors and our executive director, wherein interest in apple and other specialty crops was expressed. It is clear there is ample interest in the output from this orchard. Over the next 4 years, as we approach harvest, we plan to focus on obtaining at least 5 regional schools expressing interest in purchasing apples, at least 2 written expressions of interest, and at least 200 volunteer hours from Ohio County schools students.

Benchmark	Target (from Project Description)	Actual
Interim expert design review (score out of 100)	85 or higher score, with specific plans to address any deficiencies	Orchard design and implementation was carried out under advisement from experts, but formalized scoring system was not used (see discussion above)
Implementation expert review (score out of 100)	85 or higher score with action plans for ongoing monitoring and improvement	Orchard design and implementation was carried out under advisement from experts, but formalized scoring system was not used (see discussion above)
Interest from potential new farmers	3 regularly contributing student interns 8 sometimes contributing student interns 2 visits each from members in FFA and 4H 100 visitors from students in Ohio County schools All workshops filled to at least 75% capacity	These benchmarks were achieved via our Americorps service-volunteers. We have not yet received visitors from FFA and 4H, but plan to do so as the orchard approaches maturity/harvest. We have not yet received visitors from Ohio County Schools, but plan to do so as the orchard (and all of our sites) receive improvements in winter 2017-2018 toward site accessibility. Likewise, we have not yet held formal workshops. We plan to do so in coming years re: grafting, pruning, and general orchard care.
Interest from	At least 5 regional schools	Emphasis on school interest is

regional schools	expressing interest At least 2 written expressions of interest At least 200 volunteer hours from Ohio County schools students	delayed, as a result of delayed planting times (reasons discussed above). We will actively pursue placement of apples into public school over the next several years, as trees reach maturity/harvest.
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7. Beneficiaries

The number of beneficiaries already impacted are listed here. We anticipate many more beneficiaries in coming years, as most project beneficiaries will be affected once *apple harvest begins in 2020-2021*. Further discussion below:

- Future and existing crop producers: 15

The potential economic impact of this project:

- Dollar value of crops harvested from previously un-usable land is \$108,000 annually, or **\$1,080,000** over a ten year expected lifespan from GOV’s dwarf apple trees.
- This orchard already employs 1 FTE employees. That number will grow to **2 FTE employees** as the orchard reaches harvest-ready stage.

1 - Future and existing specialty crop producers: The Vineyard Hills Orchard has capacity to become an exceptional training venue. Already, regular service-volunteers have gained requisite skills for orchard establishment. Many more have been exposed to the basics of orchard vocabulary, layout, and technique via participation in our workdays.

We anticipate hosting many more specialty crop producers and volunteers of all ages. Enhanced focus on outreach and educational programming will be facilitated by site accessibility improvements this winter, including:

- Comfortable and safe walking paths and stairs (including Poison ivy eradication)
- Removal of hazardous rubble and logs
- Timeline: maturing trees and approach of harvest = enhanced teaching opportunity and student interest

2 - Value-Added Producers: The demand is clear: We are aware of 10+ value-added producers in the upper Ohio Valley that are seeking local fruits for their products (including canned goods, baked goods and fermented products). Still, no commercial producers of fruits have emerged in the local market, making this orchard unique in its ability to source a growing market demand and – by example - inspire enhanced specialty crop production across the region.

3 - Increased Public Health and Satisfaction: when actively producing, this orchard will provide for the in-school organic apple consumption of 1000+ Ohio County school students, while providing a nutrient rich fresh food option to residents of the Ohio Valley. Aside from that significant contribution to our community, we will gauge the orchard’s long-term success on its

ability to inspire and motivate increased specialty crop production across our region, resulting in broader scale remediation efforts and local food consumption.

4–*Restaurants*: when actively producing, this orchard will source restaurateurs who are showing increased interests in local food.

5 - *City and Local Governments and their Constituents*: while the orchard is not yet actively producing, the city of Wheeling and its residents have benefit from seeing this project take shape. It is contributing to the sense of increased pride and community optimism that has swept into our region.

8. Lessons Learned

- ***Go the extra mile to exclude deer***: If you have high deer pressure, make your fence 3-dimensional. We accomplished this by sticking dowels into the top of our fence posts at an angle, and then running a secondary tensile wire at the end of the dowel (a ploy often used on chain link fences with barbed wire). *See figure 8.*
- ***Avoid cicada bloom-years***: cicadas can be devastating to young trees. It is highly important to plan new orchard plantings around cicada emergence events (we delayed our first tree planting a full year). Several local orchardists complained of high levels of tree-loss after making plantings in 2016.
- ***Make friends with an orchardist near you***: They will be an endless source of inspiration and know-how (and scion-wood for grafting). We have found local orchardists and industry professionals to be very giving with information and support.
- ***It pays to mechanize***: we used a skid steer with an auger attachment to dig all tree holes and fence post holes. This reduced digging time by 90%+, especially important in that hole digging needs to be done quickly during dry spells to avoid undue soil structure damage. It's worth noting that tree hole sides were 'burnished' by the auger, creating a hard-pan sidewall that would be difficult for tree roots to penetrate. In response, we chopped all tree-hole sides with a spading fork to break up hardpan. Hard work, but small potatoes compared to the massive effort of digging 500+ tree holes in our rocky clay.
- ***Expect unforeseen things to go wrong***: We hit underground utilities 3 times (!) while digging tree and fencepost holes. Gas line breaks are particularly disruptive to workflow and annoying to neighbors.
 - Each time we hit utilities, we *had already called* 811 and had utilities marked by utility professionals. As such, the utility companies accepted responsibility for all repairs. Regardless, the disruption to workflow was significant. We are certain that, had we not called 811, we would have hit many more underground utilities.
- ***Economize fence posts***: in retrospect, we could have used fewer fence posts. We placed fence posts every 20' around the majority of the orchard. In straight runs with no elevation changes or constant elevation changes, fence posts every 40'-50' would be

adequate. One veteran flat-ground orchardist stretches his post distances to 100', using extremely high tension (and phenomenal corner bracing) on his tensile-wires.

- **Be vigilant searching out pests:** Aphids have been our most consistent pest presence on our young trees. They cause a physiological symptom known as “leaf-curl”, wherein the apple leaves curl in on themselves. Once leaf curl is established, aphids are nearly impossible to kill with sprays; they are hiding in the very leaves that they caused to curl. We had this problem, which we overcame with several releases of ladybugs. Thereafter, we used regular neem oil sprays to keep aphids at tolerable levels (and some ladybugs stuck around to help the cause).
- **Be attentive:** As often as possible, walk through the trees, look closely at their leaves. Take pictures of possible problems and send them to experts, extension agents, and experienced orchardists. Look, ask, and look some more. When confronted with problems, try to look at it from multiple perspectives (especially when constrained to the organic method, which often doesn't have easy answers).

Contact Person

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Additional information:



Figure 1: Clearing fallen trees from orchard site with Doug Flight (employee), and community volunteer (Daniel Jackson). See public housing above.



Figure 2 - Site Map



Figure 3 - Artist's rendering of orchard, courtesy of Gabe Hays PLA and Jocelyn Carlson



Figure 4 - Mulched tree rows with first-year dwarf trees. Note trellis system – bamboo poles at each tree, stabilized by top wire at 8' height. Posts made from rot-resistant locust and osage-orange trees in adjacent forest.



Figure 5 - Orchard nursery. Left 2 beds with rootstocks planted, third bed under construction



Figure 6 - Moving compost into orchard



Figure 7 - Community volunteer day - pulling thistle.



Figure 8 - Perimeter fence, showing supplemental wire 2' out from primary fence. Note: white flags make fence more visible to deer.



Figure 9 - Flower beds planted via GrowOV's "Project Worm" for disabled adults. Purpose: attract beneficial insects. Beautify.

PROJECT TITLE

West Virginia Department of Agriculture Producer Education 2014-2017

Amount Awarded: \$41,777.20; Amount Expended: \$20,189.43

Project Summary

In order to increase the competitiveness of specialty crops in West Virginia, it is recognized that a growth in growers and products in the marketplace is needed. This project focused on a whole agribusiness and risk management based decision making education to crop and value added product specialty crop growers/manufacturers. Through the delivery of several curriculums and learning opportunities, an increase in new agribusinesses developed as well as value added specialty crops added to the marketplace were the emphasis and outcomes of the project activities.

Projects with similar title and educational goals have been funded by the SCBGP. With that being said, the curriculum set and offered programs are based on the needs of the specialty crop industry and are often connected with best practices of legislative mandates. For this reason, the individuals that participate in the programs (with the exception of GAP reimbursement programs) are new, beginning, socially disadvantaged or expanding specialty crop enterprises. The credentials obtained are specific, one-time programs. Although the scope of offerings and technical assistance may be repetitive, the program participations are constantly revolving.

Project Approach

By providing required and optional training programs in processing, growing and marketing of specialty crops, growers and manufacturers would be allowed and encouraged to expand or introduce products into the marketplace. Providing the risk based decision framework in each of these programs would also allow the transfer of skills and provide foundational business skills aimed at enterprise success. Programs explored included support for an agritourism tour of specialty crop focused operations, Cornell's Food Safety Investigation course, Better Process Control School, GHP/GAP training, MarketReady curriculum and the development and delivery of Writing Your Food Safety Plan. Technical support, instructors and curriculum materials were included in the expense portion of this award.

This project, though all funds were not expended, provided some key accomplishments that are critical in moving the production, processing and sales of specialty crops forward. These include the development and implementation of a formal GAP reimbursement request program, and the delivery of a specialty crops focused agritourism tour.

Goals and Outcomes Achieved

The project, despite significant underutilization of funds, met its goal of 10 new specialty crop growers/processors (2 agritourism, 4 produce and 4 value added specialty crop) and more than 27 new products introduced to the marketplace. The goal of 10 firms utilizing GHP/GAP reimbursement funds was not met.

Three GAP introductory courses were presented with 65+ participants attending as well as a Better Process Control School. The agritourism/specialty crop focused bus tour was attended by 30 growers and service providers who spent 2.5 days in the Raleigh, NC region. A “classroom on wheels” guide with post visit work in transit provided a very interactive and effective learning environment. The GAP reimbursement program was fully implemented and the program’s growth is documented below. To accomplish the specialty crop risk management training, a module within the Annie’s Project throughout the state provided this valuable data to 37+ growers in the state.

Activities that were not completed (hence, the return of some obligated funds) included the Recall or HACPP course (other agencies covered the costs of these program), Market Ready modifications were completed with separate funding from WVU and a modification to the curriculum-only distribution of the FSI program to 8 secondary and junior high agriculture programs.

With a significant investment in specialty crop education in this project, the addition of new agribusinesses and specialty crop products far exceeded the 15 target (8 new companies in Better Process Control School with 23 new specialty crop value added products in the marketplace) and 7 new specialty crop growers in Preston County are examples of measured outcomes from this project. With the increase in GAP audits and initiation of the reimbursement program, the chart below recognizes the attainment of 7 new food safety plans (required for a GAP audit) and 5 new emergency procedures plans for agritourism based specialty crop entities as well as a farm safety plan demonstrate the effectiveness of the program in its limited delivery.

Year	Number of successful/reimbursed GAP Audits
2015	7
2016	14
2017	19

Beneficiaries

The immediate beneficiaries were the 87 program participants in the course provided as part of the producer education series. Beyond the immediate beneficiary impact, consumers statewide and regionally who were able to experience new product introduction and additional commerce generated are difficult to quantify due to the diverse nature, however, it is clear that the impacts of more and diverse product entry into the marketplace is sustainable and extends beyond the grant period. Retailers in at least 23 wholesale and retail outlets benefitted through new product for their inventory.

Lessons Learned

The implementation of this project was difficult due to several factors. The elimination of the Marketing Division and a reduction in staff able to carry out the programming demanded of this project created a challenge. Expanded programming and funding for produce safety to comply with FSMA regulations meant an influx of new curriculums and funding sources independent of SCBGP dollars. The final GHP/GAP courses in the state were conducted under these funds but the creation of the WV Food Safety Training Team and a blended curriculum for GHP/GAP and FSMA negated the need for several of the scheduled programs. A revamp of the MarketReady curriculum with private funding meant that only one course was conducted for this program. For the GHP/GAP reimbursement program, a movement towards additional firms requesting this voluntary audit program remained consistent through this grant cycle. Later years (2016) would see a significant increase in this farm audit program and the funds have been more efficiently utilized in later years. Through all of this, usage of the funding that was utilized created significant market and expansion opportunities in the specialty crop arena.

The development of a standard measurement tool and gathering adequate responses were not accomplished during this period. Alternate measurement (i.e. label approvals) methods were employed to verify measurement results.

Contact Person

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Additional Information

N/A

PROJECT TITLE

West Virginia Veterans to Agriculture Honey Production Project

Amount Awarded: \$15,000.00; Amount Expended: \$7,763.21

Project Summary

The Veteran and Warriors to Agriculture Beekeeping Project was created with the goal of training veterans in honey production to lead to entrepreneurship, and to help veterans that suffer from PTSD find therapeutic relief in beekeeping. For this project, we recruited and trained 25 veterans. We have advertised for opportunities like this to veterans across the state including the 200+ veterans registered in our program. We have promoted veterans' products to countless people and have educated consumers on veteran made products at events like the West Virginia State Fair. Our goals coincide with the rest of the WV Department of Agriculture's plan to increase revenue in the state through agriculture. It is our duty to ensure that West Virginia's veterans have a part in that success and find a rewarding career after service.

The original Veterans to Agriculture honey project focused on the initial interest and hive care in the context of an agriculture enterprise alternative. The desired result was the creation of interest in agriculture enterprises as part of post service career exploration. This project built on this interest and focused on the development of an agriculture enterprise through training and education.

Project Approach

The main approach of this project was to train veterans in beekeeping with the least amount of startup costs to the individual, and to provide an opportunity for them to generate income sooner. Listed below is the methods we used to achieve this.

Train and educate veterans in a four-part class to qualify them for \$300 worth of beekeeping equipment provided by Veterans Assistance (originally from West Virginia Education Fund). The training sessions were paid with the grant to a veteran owned business, Geezer Ridge Farms, who also completed the necessary paperwork for each participant that completed the class to receive funding for personal equipment. The equipment included two brood boxes, a nuc package, and additional hand tools with a total value up to \$300.

Four honey extractors were purchased from the grant to provide veteran's a way to learn how to extract, and to extract their own honey without incurring additional startup costs. Provide veterans with the option of using product labels that advertise the program to prevent additional packaging costs to participants. Buckets with the Veterans and Warriors to Agriculture branding were purchased with the grant to be provided to veterans that wished to extract their honey with the programs extractors. Labels were also designed and printed for 1lb jars for any veterans that wished to sell honey under a unified brand.

Goals and Outcomes Achieved

Enroll and train 10 participants in the Honey Production Project.

25 veterans were trained to the specifications of the Veteran's Assistance to receive funding during the 3-year period. This goal was exceeded by 60%.

50 percent of participants will complete a business plan.

252 participants completed a business plan. Participants were furnished templated business plan models from the provided course text, however, only 2 participations completed a viable business plan with others still working on the development of their agriculture enterprise. This target was not met and additional work as well as referrals (i.e. SBDC veteran curriculums) mean that this goal attainment is ongoing.

By the end of the grant cycle, at least 1,000 lbs of honey will be processed by veterans with the equipment bought for the grant, and then labelled for individual sale.

1,158 lbs of honey was extracted from the extractors bought for the grant. Most declined the premade labels, opting for more personalized ones to promote their direct sale business while highlighting the Veterans to Agriculture project. The results were 14% above target. The original targets proved goals based on retail bottle production levels. Based on an average weight of these units, the total pounds harvested allowed verification that these targets were met and exceed at the conclusion of the project.

Participation in potential producer workshops exceed the projected 40 by more than 160 as 200+ workshop participants were registered.

A divisional move and change in registration processes mean that the project proposal registrants and apriary increases were not recordable. The original target of 300 percent was not measured, however, all program participants (25) completed registration processes.

Beneficiaries

The 25 veterans trained by this program.

The 200+ veterans that are advertised opportunities like this.

The expansion of the network of beekeepers in the state.

Current veteran producers having their products co-promoted.

Lessons Learned

Each defined role at the start of the grant (specifically the individual with spending authority) should be maintained by the same person throughout the entire grant cycle if possible.

During the 3-year grant cycle, administrative duties and responsibilities defined by the grant have not been maintained by the same person, persons and/or group. This has caused: delays of purchasing supplies required, delays in payment to the trainer, purchasing of supplies without notice to all parties involved, and some of the objectives defined in the grant to not be met.

Dedicate more resources to individual brand development instead of unified labels.

Most veterans and producer in general want to use their own labeling on their product. Now that the WVDA has access the Homegrown by Hero's logo, future veterans in the program will be able to use veteran branding without compromising use of personalized product labels.

More focus on geographic diversity.

Most apiary training in our program takes place in the Eastern Panhandle of the state. We have had difficulty finding skilled and willing trainers in other parts of the state. Fortunately, we have found veterans willing to travel to learn the skills in order to be trainers in their areas in the future.

Establishing obtainable goals (with input from trained professionals) during the submittal process to reduce the need for modifications.

The grant had been modified twice during the last year of the grant, specifically to change the goals to be more realistically obtainable. The frequent modifications of the grant have created more administrative overhead and more time invested than needed.

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PROJECT TITLE

Wild Flowers for Honeybees

Amount Awarded: \$3,100.00; Amount Expended: \$3,094.22

PROJECT SUMMARY

West Central Beekeepers Association (WCBA) is made up of beekeepers from Calhoun, Roane, and surrounding counties in West Virginia. It is the goal of WCBA to increase and stabilize the honey bee population in our geographical area in an effort to produce more honey for sale and also to aid the local farmer in the pollination of crops. Through the introduction of Honey Bee Wildflower Seed Mix to be sown as an additional food source, we hope to expand the number of honey bees and help stabilize their environment by providing appropriate food sources, enabling them to survive thus producing more honey. This project is important due to the natural purpose of the honey bee. Not only does the honey bee produce honey, which can add to the economy of the area, but it also pollinates local crops, increasing production of local fruits and vegetables. The Farmer's Markets of the area will have more produce for sale, which in turn will boost the local economy. By collecting baseline data through surveys, we will be able to monitor over a two-year period the stability of the bee colonies as well as any increase in honey production.

This project built on a previously funded project with the SCBGP that helped Beekeepers purchase nucs of honeybees. It complimented and enhanced previous work completed by providing additional food sources to strengthen the health of the honeybees and in turn enhanced the availability of honey for consumption and sales in the region.

Project Approach

This project addressed the need for an enhanced food source for the honey bee. This project is important and timely because the honey bee has been disappearing from the local area and without the honey bee, pollination of crops will diminish and the production of honey will become a memory. Wildflowers are needed to enhance food availability for the honey bee, thus increasing the amount of honey produced.

The project was designed to purchase and sow wild flowers for honeybees in the west central part of West Virginia. The West Central Beekeepers Association purchased the seeds and distributed those seeds to their members to be planted by the members at monthly club meetings. The Association then distributed surveys of honey production and survival rates of the honeybees to the members at various club meeting to collect data. They also had grant committee members contact members by phone to collect additional surveys and anecdotal information for the project.

The objective of this project was to purchase and distribute Honey Bee Wildflower Seed Mix to local beekeepers in an effort to expand the available food sources for the honey bee, thus producing more honey. Records were kept of expended funds on the purchase of wildflower seed which was purchased. This project was not a continuation of any SCBGP program

previously funded. This project has not been submitted to any other Federal or State grant program.

First, please note that our geographical area is not very prone to drought conditions; however, since the plots to be planted will be in close proximity to individual apiaries, it will be a small matter to monitor the plots and take necessary action as needed.

In modern times, mowing of roadway berms has been extended by the long arm reach of modern cutting equipment, as well as spraying of guard rail areas and rights of way, which has greatly reduced the wild flower habitat. Much of the Fall honey flow depends on “wild flower” bloom, such as a variety of Vetch, Corn Flower, Shoemake, and other varieties. Planting wild flowers in bulk plots will create a definite source of wild flower pollen as a food source, as well as nectar to increase honey production.

Fall pollen is essential to the winter health of the honey bee.

Project activities included:

- Participants were recruited
- Wildflower seeds were ordered and sowed for each of the project years. Note: Most beekeepers have noted that second year wildflower seeds had much better germination. (photos attached)
- Surveys were prepared and distributed in the spring and fall of each project year.

The majority of the project activities were carried out by the Association membership, however, additional project support was recognized by the Roane County Extension agent (education and survey collection/analysis).

GOALS and OUTCOMES ACHIEVED

Even though we experienced climate related problems of too much wet weather (ie June 2016 flood and continued wet weather) and times of dry weather which caused honey production to be slowed, increased number of bee hives and honey production was noted as shown by the enclosed table.

	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Ave
No. of Beehives	220	113	197	129	236	164	231	149	249	Fall 227 hives Spring 130 hives
Survival Rate from Fall to Following Spring		51.4%		65.4%		69.5%		64.5%		62.7% Survival Rate

Honey production has increased by 38% as a result of supplying the honeybees with food sources from the wildflowers.

Winter survival rates were tracked and we now know that our area typically sustained around a 63% winter loss of honeybees. Having this knowledge will help us to better educate our beekeepers in preparing honeybees for winter to improve our loss rate in the future.

From our paper surveys of beekeepers, we learned that we have a more realistic 63% loss rate during the winter for honeybees in this area. However, after some harsh weather that effected our colonies in 2016, we saw a 5% improvement in winter survival rates in our honeybee colonies in 2017. This slight increase could be attributed to our efforts to increase the food source from the planting of wildflowers in the area.

Overall, our honey production as a result of this project showed a 38% increase in production, which exceeded our 12-15% target to increase production. This project was a success.

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ADDITIONAL INFORMATION





PROJECT TITLE

Real Flavors

Amount Awarded: \$42,114.11; Amount Expended: \$42,000.00

Project Summary

Real Flavors was a multi-agency collaboration designed to provide consumer education and awareness about West Virginia specialty crops. The approach was the development, production and distribution of a five part, 30 minute Appalachian Food Evangelist series to be aired on public broadcasting featuring specialty crop producers, agritourism farms and entities focused on specialty crops and current/past specialty crop block grant projects that provided significant crop availability at the geographic regions throughout the state. In addition to their contribution to the series through an agritourism interest, the WV Division of Tourism provided significant financial cost share resources and agreed to head up the social media analytics that measured the effectiveness of the campaign.

This project did not build on a previous SCBGP or SCBGP-FB project.

Project Approach

Tying West Virginia/traditional Appalachian specialty crop cuisine and developing a robust culinary tourism product were the “ingredients” that forged the partnership between the WV Department of Agriculture and the West Virginia Division of Tourism. Working with Chef Dale Hawkins, recognized throughout the region as a Appalachian centered chef with a strong menu investment in both farm to table and specialty crops, the project developed 5 30-minute television segments featuring specialty crop agritourism, restaurants and specialty crop growers/projects aired on PBS. In addition to the traditional media development, the project relied heavily on social media to promote viewership and spark recipe and crop interest.

Grant funds were used to produce, edit and distribute the 5 segments (originally slated for 4) to create and interest and purchasing to all viewers emphasizing millennial demand as a market segment with an interest in the regional specialty crop cuisine experience. Each seasonal segment featured specialty crop focused recipes, demonstration and interview with the farmers and program leaders who contribute to the state’s agriculture and tourism industries.

Using seasonal menu themes, the *Real Flavors* series produced 5, 30-minute segments that aired on WV Public Broadcasting. In addition to the production costs and technical assistance in each of the day long production segments, a social media campaign was developed to encourage participation and feedback. Working with more than 25 growers and produce outlets, the series provided a forum for specialty crop focus and featured foods/locations for visitors to the state. A unique partnership with tourism as well as insight into the television media were experienced by participants and viewers. Collection of social media results concluded the activities of this project.

The gathering of social media analytics was an integral part of the program development with the Division of Tourism. With an expert analyst and robust “Real” campaign, social media accounts across many platforms (Facebook, Twitter, YouTube, Instagram, etc.) were created under the hash tag #Appalachian Food Evangelist. See the Lessons Learned below to explore the issues and problems with this strong outcome indicator and why viewership is the only measurable outcome quantitatively for this project while the antidotal reports were very positive.

Goals and Outcomes Achieved

Social Media Vehicle	Baseline (tracked)	Episode #1	Episode #2	Episode #3	Episode #4	Episode #5	Overall Increase
YouTube/Vimeo	0	2,016	2,496	3,014	3,204	3,264	+38%
Facebook	1,162	N/A	N/A	N/A	N/A	N/A	Undetermined
Twitter	798	N/A	N/A	N/A	N/A	N/A	Undetermined
Pinterest	347	N/A	N/A	N/A	N/A	N/A	Undetermined
Instagram	N/A	N/A	N/A	N/A	N/A	N/A	Undetermined
PBS Viewership	350,000 (baseline)	350,000	350,000	350,000	350,000	350,000	*
GoToWV and WVDA website hits	2,315	N/A	N/A	N/A	N/A	N/A	Undetermined

Other results: Traveling WV (WCHS), Bon Appetit Appalachia, WV Living magazine, tags

*Not trackable

**Not tracked

Note: The “baseline” tracked data are the numbers that were recorded as of the grant close date (with the exception of the YouTube 350,000 PBS viewership numbers which are based on Arbitron data that cannot be tracked to specific episodes. Though the numbers and antidotal feedback reflect adequate ROI for the project, they do not meet the measurable outcome criteria established with the Project Description as they do not demonstrate sustained and building brand recognition for the series. The reason for this lack of data is explained by the administrative change at the partner organization (Tourism) who initiated the project idea and at the time of implementation was the reporting source. Once the social media accounts were established, there was no monitoring at key project timelines and episode airing.

Unfortunately, all the principles that set up the reporting criteria are no longer with the agency, hence, the cumulative numbers and historic exposure numbers reflected. The YouTube/Vimeo numbers were tracked by Agriculture, hence, the meeting of the target outcome, however, this is insufficient data to conclude that each of the media outlet metrics were similar in results. These sites are now under the administration of Agriculture and the lesson learned is the need to monitor reporting mechanisms throughout the entire project timeline to be sure that partners are tracking appropriate analytics.

Beneficiaries

With a viewership of more than 350,000 households, the reach of WV Public Broadcasting would be the most obvious beneficiary of this product. Realistically, the combined reach of the 5 part series can be measured at 100,000 per episode or 500,000 views. Additional view on YouTube and Vimeo are not factored in but can estimated at 100 per episode for an additional 500 households impacted. The more than 25 farmers who participated in the series provided specialty crops and series content making this project successful at reaching a variety and many households.

Lessons Learned

Although deemed a success, a mid-series leadership change at both agencies meant that the project did not meet its full potential. Particularly disappointing was the lead on the social media implementation and administration was pulled from the project without notification yielding no significant results that could be used to document the measurable outcomes. By the final episode, the Division of Tourism underwent historic reorganization and the Division no longer exists in its past format. Viewership, consumer feedback and informal anecdotes gauged interest and program results. A switch in media outlets after the first episode (YouTube to Vimeo) on the part of the production company made additional tracking impossible. In the future, projects and collaborations such as this that rely on a strong social media indicator need to be monitored throughout and organizational/leadership changes may mean project leads and responsibilities need to shift. Fortunately, future endeavors and collaborations have not been impacted and the WV Department of Agriculture has developed more robust analytic capacity so that internal results can be more fully measured.

Contact Person

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Other Information

Episode #1: <https://www.youtube.com/watch?v=Fgh0bugPGoU&feature=share>

Episode #2: <https://www.youtube.com/watch?v=SI3WX8WjD-s>

Episode #3: <https://vimeo.com/243139688>

Episode #4: <https://vimeo.com/243142756>

Episode #5: <https://allenell.is/clients/afe/s01e05>



