

**Virginia Conservation Innovation Grants (CIG)
Final Project Report**

Healthy Farms from the Soil Up: Finding Common Ground

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Executive Summary

This Conservation Innovation Grant (CIG) addresses soil health, a priority for USDA-NRCS. We specifically focused on finding and building common ground around soil health management through innovative partnerships and educational outreach across agricultural and conservation communities. The educational programming and outreach products focused on four project objectives: 1) to develop an intermediate level soil health curriculum endorsed by and useful to both Virginia Natural Resources Conservation Service (NRCS) and Virginia Tech/Virginia Cooperative Extension; 2) to encourage farmer-to-farmer learning through on-farm demonstrations, case studies and testimonials of innovative farmers as 'Soil Health Champions' for Virginia who could share their applications of soil health principles on reduced tillage and cover cropping in specialty crop production; 3) to increase adoption of summer and winter cover cropping systems; and 4) to prevent soil loss and nutrient runoff through demonstration, training and promotion of Virginia USDA-NRCS' rainfall simulator. The fundamental project goal was to ensure key Virginia partners, including NRCS, Land Grant Universities and Extension institutions, other agencies, and a broad range of farmers, find and stand on "common ground" with respect to soil health principles and some consensus of vocabulary and messaging.

We specifically collaborated with five farms in the Shenandoah Valley and Northern Piedmont regions. An S & S Marketing Lift N' Till strip zone tillage implement (Specialty Sales, Sumner, GA) and a Monosem Two Row Planter with a Yetter Coulter (Monosem Inc., Lenexa, KS) were purchased with Conservation Innovation Grant (CIG) funds as an innovative soil conservation technology to demonstrate on commercial vegetable operations in these regions. The collaboration with these cooperating farms resulted in several changes in farming practices: a) increased no-till cover cropping practices; b) reduced reliance on black plastic as a weed control method (plasticulture) on a commercial vegetable operation in Page County; c) better understanding of how no-till can be implemented on an 30-acre organic commercial vegetable farm in Loudoun County without using herbicides; and d) adoption of a new cover crop rotation and no-till panting of cover crops as part of a soil health building 'vacation year' concept. Virginia Cooperative Extension worked with USDA-NRCS, AE Media, and three of these cooperating farmers to produce and publish 11 soil health videos and technical clips. This educational outreach method resulted in 16,484 online views from December 2015 to July 2017. Educational programming and outreach included 23 training events, which accounted for 45+ hours of instruction. Face-to-face soil health instruction reached over 1,500 people including Extension/USDA professionals and mentor farmer-leaders.

We recommend commercial vegetable farmers minimize soil disturbance caused with tillage by utilizing available conservation tillage and planting technologies and explore more cover cropping options in their cash crop rotations. With proper preparation and planning, a soil health building 'vacation year' devoted to cover cropping and sabbatical rest can be a good investment and fit a whole farm plan and multi-year cash crop rotation. Virginia USDA-NRCS can continue to help accelerate the adoption of these practices by partnering with Virginia Tech and farmer-leader mentors to demonstrate innovative technologies and emerging equipment that may not be readily available or easily accessible in some farming regions through cost-share or rental agreements.

The overall net outcome of this project was an exceptionally high degree of partnership and consistency in messaging about soil health across the targeted northwest region of Virginia. Notable outcomes included: 1) a flourishing partnership and linkage between NRCS and VCE, which resulted in a better understanding among NRCS and VCE personnel of each organization's priorities and a much stronger relationship between NRCS and the Land Grant University system at multiple levels, 2) NRCS and VCE personnel are far more likely to partner on educational soil health programs today and use similar vocabulary to promote key soil health concepts and principles than they might have prior to this CIG project, and 3) innovative linkages and outreach efforts helped extend VCE and NRCS educational ideas and conservation resources to new audiences to overcome skepticism and misgivings about information from Land Grant Universities and USDA.

In regard to soil health education and outreach, any Virginia soil health curriculum should use *Building Soils for Better Crops* (Magdoff & Van Es, 2009) as a foundational textbook. The book is thorough and can serve as a key reference for students who want to dig deeper into more soil health topics or quickly review integral concepts. Effective soil health educational programs should emphasize hands-on soil demonstrations and farmer case studies. The recommended strategy would be to present core soil health concepts and principles, then use demonstrations such as the table-top aggregate stability test or outdoor rainfall simulator to illustrate and reinforce the concepts. Overall, Virginia USDA-NRCS and Virginia Tech should continue to partner to capture testimonials of Virginia farmers and produce videos to expand their educational outreach efforts and peer-to-peer learning.

Deliverables

Deliverables identified in the grant agreement and project outcomes:

- ***An intermediate level soil health curriculum will be developed that focuses on behavioral change among the farming and conservation community. The curriculum will include a strong emphasis on farmer-to-farmer learning as peers and mentors.***

The objective of providing train-the-trainer educational materials as part of an intermediate level curriculum was modified slightly as the project developed to optimize face-to-face training opportunities and peer-to-peer networking both of farmers and Extension and NRCS personnel. The grant team identified two USDA books, *Building Soils for Better Crops* and *Managing Cover Crops Profitably*, as excellent curricular resources that already exist and just needed to be highlighted and used more broadly. Therefore, these books were utilized in soil health trainings and distributed to attendees as foundational resources for ecological soil management (Magdoff & Van Es, 2009; Clark, 2012). The books were the primary resources used to develop six modular-type PowerPoint® presentations that address USDA-NRCS' core soil health principles. Additional materials and educational resources were gathered and curated from USDA-NRCS, research and extension publications of Land Grant Universities, peer reviewed soil science publications, and some trade publications. Videos with farmer testimonials and case studies were collected and added to the training material because innovative farmers like Gabe Brown, Dave Brandt, and others are out front of the research and extension community on many soil health topics. The educational materials and resources can be accessed at Virginia Cooperative Extension's Soil Health and Cover Crops topic page at

<https://ext.vt.edu/agriculture/soil-health.html>. The videos and technical clips can also be accessed on Virginia USDA-NRCS's YouTube Channel.

Virginia Cooperative Extension
Virginia Tech • Virginia State University

Agriculture Community & Leadership Natural Resources Family Food & Health Law

Soil Health and Cover Crops

Soil is a foundational resource to farming, conservation and health in the 21st century. Soil health, also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. Key concepts of soil health and ecological soil management include protecting soil habitat; managing more by disturbing less; keeping soil covered; diversifying food and carbon sources for soil microorganisms; diversifying plant and animal communities; and growing living roots throughout the year. This topic page will focus on how to build soil health for improved soil function and better crops.

What's New Topic Programs Academic Programs

About Soil Health Video & Webinars Resources Website Links

Blogs

- » [Virginia NRCS Cover Crop Planning Manual 1.0 \(PDF\)](#)
- » [SARE Cover Crop Image Gallery](#)
- » [SARE Soil Health Gallery](#)

New Video and Technical Clips (Jan. 25, 2017)

- » [Starting with Soil at Waterpenny Farm](#)
- » [No-Till Vegetable Experiments at Fauquier Education Farm](#)
- » [Fine-Tuning Fertility at Potomac Vegetable Farms](#)
- » [Experiments with No-Till Cover Crops at Potomac Vegetable Farms](#)

New Video and Technical Clips (Dec. 15, 2015)

Featured Publications

- » [Building Soils for Better Health](#)
- » [Managing Cover Crops Profitably](#)
- » [Agricultural Management Practices And Soil Quality: Measuring, assessing, and comparing laboratory and field test kit indicators of soil quality attributes.](#)

Related Topics

- » [Irrigation Pathogens and Water Quality](#)
- » [Soil Information](#)
- » [Turf and Garden Tips Podcast](#)

Events

- » [Crops & Soils calendar](#)

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Follow Soil Health

Figure 1. Virginia Cooperative Extension Soil Health and Cover Crops topic page with curricular and educational materials.

- **At least three on-the-ground demonstrations of soil improving practices, including but not limited to cover cropping, will be organized on farms or research stations during the project period. These demonstrations will support and be integrated with the educational components of the project.**

Virginia Tech and Virginia Cooperative Extension faculty worked cooperatively with USDA-Natural Resources Conservation Service to demonstrate soil health building practices on five farms in the Shenandoah Valley and Northern Piedmont Regions: Public House Produce, Waterpenny Farm, Potomac Vegetable Farms, Fauquier Education Farm, and Messicks' Farm Market.

- At least two on-farm field days and two twilight farm tours for farmers and their advisors.***
 Educational programming and outreach included 23 training events, which included field days, tours, and conferences to account for 45+ hours of soil health instruction. An intensive soil biology training was part of the 2014 Virginia Farm-to-Table Conference at Blue Ridge Community College and Virginia State University was attended by 427 people. The two 6-hour in-depth soil biology trainings at the two sites reached 215 farmers, 87 soil conservationists of Virginia's NRCS field staff; 27 employees from soil and water conservation districts; 36 Extension agents and specialists; and 61 representatives from non-profit organizations. Overall face-to-face soil health instruction reached over 1,500 people including Extension/USDA professionals and mentor farmer-leaders. A key theme was allowing demonstrations or guest speakers to convey the project's message in their own words. Guest speakers such as Dr. Elaine Ingham of Soil Food Web, Dr. Ron Morse and Dr. Mike Strickland of VA Tech, and farmers Gabe Brown, Alex Hitt, Ellen Polishuk, Mark Schonbeck, Bill Cox, and C.J. Isbell presented very different information in their own personal way. However, they all emphasized the foundational principles of keeping the soil covered and minimizing disturbance to boost the power of soil biology.
- At least four localized farmer-soil health case studies and testimonials will be developed and uploaded to Virginia Cooperative Extension's and partnering organizations' websites.***
 We worked with cooperating farmers who could articulate core soil health principles succinctly and share their life experiences of building soil health on their farms at educational events and through video materials (e.g., Ellen Polishuk of Potomac Vegetable Farms, Jim Hankins of Fauquier Education Farm, and Rachel Bynum of Waterpenny Farm). Towards this deliverable, Virginia Cooperative Extension worked in collaboration with USDA-NRCS, AE media, and cooperating farmers to produce and publish 11 soil health videos and technical clips to expand the scope and outreach of training materials. This outreach method resulted in 16, 484 online views of the educational videos from December 2015 to July 2017. USDA-NRCS was also able to record Ellen Polishuk's 1-hour soil health workshop at the 2015 Virginia Farm-to-Table Conference entitled, Making Soil Health Come First—Building Your Ground While Staying Profitable in the Vegetable Business. The videos can be accessed from Virginia USDA-NRCS's YouTube Channel at https://www.youtube.com/channel/UCe_p870zuROY9sM91f5JQXw and Virginia Cooperative Extension's Soil Health and Cover Crops topic page at <https://ext.vt.edu/agriculture/soil-health.html>.
- At least one soil health webinar hosted by the Virginia Beginning Farmer and Rancher Coalition.***
 The project team successfully networked with key partners to promote project outcomes at diverse outside events, audiences, and resources. The project's signature soil health video featuring Ellen Polishuk was shown at the 2017 Virginia Association for Biological Farming (VABF) Conference and its entire audience of 400 plus attendees. Another key example involves the project team's close linkages with the Virginia Farm to Table Conference. For four years, the Conference organizers made soil health education a theme at the Conference. Overall, focusing on such partnership opportunities extended the project's impact far beyond the reach of typical VCE production or NRCS conservation meetings.

We worked with the Virginia Beginning Farmer and Rancher Coalition to promote and share the soil health videos and technical clips developed as part of the CIG project through the Coalition's communications network. Rather than hosting a webinar, we specifically worked with the Fauquier Education Farm, a key partner and training venue for new farmers and the Coalition, to produce a video about the farm, their soil health promoting practices and no-till vegetable production experiments. The video is part of the Common Ground Soil Health Profile Series and can be accessed at <https://youtu.be/HZl5Ze2SepM>

- ***The USDA-NRCS rainfall simulator outreach effort will be enhanced by building capacity, ability, and interest among Extension and partners for carrying out this demonstration. At least three rainfall simulator demonstrations will be conducted during the life of the project.*** We worked with Virginia USDA-NRCS to conduct three rainfall simulator demonstrations. In 2013, the rainfall simulator demonstration was attended by 35 people at a commercial vegetable production and water quality workshop. In 2016, the USDA-NRCS Rainfall Simulator was demonstrated at the Shenandoah Valley Produce Auction's Annual Member Business Meeting. The demonstration was viewed by 112 producers within the Mennonite community including youth and women. In 2017, the rainfall simulator was demonstrated as part of a twilight tour and discussion about cover crops at the Fauquier Education Farm (n = 25). The number of rainfall simulator demonstrations was dependent on scheduling and transportation resources. Therefore, we utilized the soil slake test at four other well-attended trainings to highlight the importance of soil aggregate stability to soil health and how tillage disturbs soil function.



Figure 2. Rainfall simulation and soil slake demonstrations were utilized to emphasize the importance of keeping soil covered and minimizing soil disturbance to maintain aggregate stability. Photo courtesy of Virginia USDA-NRCS.

- ***Project leaders will regularly communicate with Natural Resources Conservation Service (NRCS) technical contact and reach out to partners engaged in other soil health promotion***

projects in order to reduce duplication and increase coordination across a range of potentially diverse soil health promotion efforts occurring across the state.

Virginia Tech and Virginia Cooperative Extension worked closely with USDA-NRCS's technical contacts and other organizations such as Virginia Sustainable Agriculture Research and Education (SARE) Advisory Committee, Virginia Beginning Farmer and Rancher Coalition, and other Extension communication outlets.

Educational outreach and marketing of soil health and ongoing resource conservation work was shared through the following websites, social media platforms, and blog sites:

VCE Virginia Farm-to-Table Facebook Page: <https://www.facebook.com/virginiafarmtotable/>

VCE Cover Crops and Soil Health Blog: <http://blogs.ext.vt.edu/cover-crops-soil-health/>

VCE Virginia Farm-to-Table Blog: <http://blogs.ext.vt.edu/farm-to-table/>

- ***Participation in at least one NRCS CIG Showcase or comparable NRCS event during the period of the grant.***

In June 2017, Virginia Cooperative Extension and Virginia USDA-NRCS partnered to host a 4-hour workshop as a CIG showcase entitled, Reduced Tillage Vegetables: The Potential and the Practical. The CIG Showcase event was held at Public House Produce in Page County and 89 people participated. The event allowed David Sours as a cooperating farmer to share his experience with no-till vegetable production, strip zone tillage equipment and planting technology, and cover cropping. Additionally, a panel of cooperating farmers shared their experiences with the CIG grant at the 2015 and 2016 Virginia Farm-to-Table Conference at Blue Ridge Community College. Members of the grant team also participated in NRCS organized CIG showcases in Hanover and on the Eastern Shore of Virginia.

- ***New technology and innovative approach fact sheet.*** Will be forthcoming.

Introduction

Soil is a foundational resource for farming, natural resource conservation, and health in the 21st century. For farmers who have transitioned into wholesale vegetable production from smaller-scale gardening operations or agronomic farming backgrounds, sound ecological soil management to prevent soil loss and build soil health can be a challenge. Peer-to-peer learning and training around core soil health principles for Extension educators, USDA professionals, and mentor farmer-leaders was a key focus and priority of this Conservation Innovation Grant (CIG) project to address this challenge and develop common ground and messaging related to soil health principles and concepts. Over the past 10 to 15 years, commercial vegetable production has increased significantly in the Shenandoah Valley and Northern Piedmont regions of Virginia as new markets have developed to meet current demand for local and regional foods. The development of these markets has enabled producers to diversify and in some cases be less reliant on animal agriculture as their sole option.

Plasticulture with tillage is a predominant standard production method for commercial vegetable operations in Virginia. In a plasticulture system, the entire field is often tilled multiple times to create a good seedbed on raised beds. A three to four foot wide sheet of plastic is then pulled the length of the

bed to provide a mulch and method for weed suppression. Drip irrigation lines are usually placed beneath the plastic as the beds are shaped and covered. Plasticulture provides production benefits such as heat capture for warming the soil to enable early planting of crops, weed suppression of competing plants, and cleaner produce from less soil being exposed to rain and splashing. The system also has limitations and risks. The intensive tillage of plasticulture systems can greatly disturb the soil profile and decrease aggregate stability. The exposed soil prior to covering with plastic is subject to erosion and nutrient loss. From a water quality and soil health framework, vegetable production with impervious surfaces and exposed soils pose an ecological and soil loss risk, stressing the need for education and outreach to farmers, Extension educators, USDA personnel, and other technical service providers about opportunities to build soil health through cover cropping and reduced soil disturbance.



Figure 3. Typical plasticulture system with plastic mulch covers and tillage to raise and shape the beds.

The project was led by Mr. Eric Bendfeldt, who is an Extension Specialist for Community, Local, and Regional Food Systems with Virginia Tech's Department of Soil and Crop Environmental Sciences and Virginia Cooperative Extension's Community Viability Program. Mr. Bendfeldt has a 100% Extension appointment and is based in the agriculturally significant Shenandoah Valley. Other key personnel from Virginia Tech and Virginia Cooperative Extension included: Tim Mize, Extension Agent, Agriculture and Natural Resources, Fauquier County; Tim Ohlwiler, Extension Agent, Agriculture and Natural Resources, Fauquier County; Kenner Love, Extension Agent, Agriculture and Natural Resources, Rappahannock County; Beth Sastre-Flores, Commercial Horticulturist, Loudoun County; Jason Cooper, Extension Agent, Agriculture and Natural Resources, Rockingham County; Dr. Kim Niewolny, Associate Professor, Extension Specialist, Agricultural, Leadership, and Community Education; Dr. Robert Grisso, Associate Director, Extension Program Leader, Agriculture and Natural Resources; Dr. John Galbraith, Associate Professor, Extension Specialist, Soil and Crop Environmental Sciences; and Dr. Steve Hodges, Professor, Soil Science and Ecology of Managed Ecosystems.

Virginia Tech and Virginia Cooperative Extension faculty worked cooperatively with USDA-Natural Resources Conservation Service, Public House Produce, Waterpenny Farm, Potomac Vegetable Farms, Fauquier Education Farm, Messicks' Farm Market, Virginia Beginning Farmer and Rancher Coalition, John Marshall Soil and Water Conservation District (SWCD), Loudoun SWCD, Prince William SWCD, and Shenandoah Valley SWCD, Virginia Sustainable Agriculture Research and Education (SARE), Virginia

State University's Small Farm Outreach Program, Virginia Department of Agricultural and Consumer Services, Shenandoah Valley Produce Auction, Virginia Farm Bureau Federation, Virginia Foundation for Agricultural Innovation Rural Sustainability, Farm Credit of the Virginias, Virginia Forage and Grassland Council, Producer Associations, Non-Profit Organizations, and others to encourage the finding of common ground around soil health, cover cropping systems, and farm-to-table connections.

An educational need for Extension educators, USDA professionals, and mentor farmer-leaders was identified to focus on and increase peer-to-peer learning and training around common messages and core soil health principles. A fundamental project goal was to ensure key Virginia partners, including NRCS, Land Grant Universities and Extension institutions, other agencies, and a broad range of farmers, find and stand on "common ground" with respect to soil health principles and some consensus of vocabulary and messaging as a result of the project's educational programming and outreach. Toward this goal, educational programming and outreach focused on four project outcomes: 1) development of intermediate level soil health materials (i.e., videos, technical clips, handouts, and six modular-type PowerPoint® presentations) as a curricular basis for train-the-trainer efforts; 2) farmer-to-farmer learning through on-farm demonstrations, case studies and testimonials of innovative farmers and their soil health practices as champions for Virginia's soil health; 3) increased adoption of cover cropping systems; and 4) prevention of soil loss and nutrient runoff through demonstration, training and promotion of Virginia USDA-NRCS' rainfall simulator. A fundamental project goal was to ensure key Virginia partners, including NRCS, Land Grant Universities and Extension institutions, other agencies, and a broad range of farmers, find and stand on "common ground" with respect to soil health principles and some consensus of vocabulary and messaging as a result of the project's educational programming and outreach.

The Extension project team was comprised of individuals who serve on Virginia's No-Till Alliance, Fauquier Education Farm, Virginia Beginning Farmer and Rancher Coalition, Northern Piedmont Beginning Farmer Program, John Marshall SWCD, Loudoun SWCD, Prince William SWCD, and Shenandoah Valley SWCD. The project team leveraged these networks and initiatives to enhance soil health outreach and implementation in the field and across the state. We also used these networks to promote and market the videos and technical clips on additional websites and electronic newsletters. Funding for the Conservation Innovation Grant was provided by Virginia's USDA-Natural Resources Conservation Service and a 1:1 match was provided by Virginia Tech and Virginia Cooperative Extension through a percent of time committed by faculty. The five cooperating farms were instrumental to the success of the grant project and provided in-kind resources of time, labor, and land for carrying out the field demonstrations and project tasks.

Background

Finding common ground can often be difficult particularly when people come from diverse backgrounds, have specific philosophic perspectives or passionate viewpoints. Virginia Cooperative Extension continues to help farms of all sizes and types of operations be viable and succeed in an ever-increasing competitive marketplace. Virginia is fortunate to have 46,030 farms and more than 8.3 million acres of farmland (U.S. Department of Agriculture's 2012 Census of Agriculture). These farms are not one-size-fits-all but uniquely different based on location, physiography, resources, size, history, and values. Virginia Cooperative Extension works to leverage agricultural and community partnerships

in education and research to develop place and values-based food systems across Virginia to serve farms of all sizes. Within this context, farmers are finding common ground around topics and their mutual interest in soil health, cover cropping, and better farm-to-table connections. Farmers mutually want people to know what they are doing to protect the environment; have a better appreciation of agriculture; how food is produced; and where their food comes from.

For the conservation and academic community, professionals and technical service providers are trying to become more comfortable with soil health principles and find common ground around a similar educational message. Within these communities, soil quality and soil function were prominently used terms in the past. Historically, soil physical and chemical properties generally received more attention in regard to soil management and fertility considerations. Discussion of soil health emphasizes soil as a living ecosystem and the need to care for the biological properties of soil as well as the physical and chemical properties. Soil health principles bring to light the importance of soil organic matter (SOM), carbon, fungi, bacteria, and soil insects as key drivers to the system and integral for building and enhancing soil's physical and chemical properties such as aggregate stability, water infiltration capacity, cation exchange capacity, nutrient cycling and release.

Within this discussion, there is a strong focus on soil health and cover cropping because soil is a foundational resource for farming, natural resource conservation, and health in the 21st century that must be used sustainably. Farmers have made significant progress in protecting and conserving Virginia's natural resources. Controlling soil loss and nutrient runoff — non-point source pollution — from all possible sources continues to be critical for water quality protection and clean-up efforts throughout Virginia and the Chesapeake Bay Watershed. Within Virginia's farming and conservation community, soil and water conservation efforts have focused specifically on the implementation of BMPs to reduce soil loss and nutrient runoff to local waterways, and leaching of nutrients to groundwater to control non-point source pollution. The emphasis on soil health encourages a holistic, systemic approach to soil management.

The soil health educational programming and outreach needs to be tailored to farmers' production context (e.g., commercial vegetables) and adaptive soil management to enhance education, appreciation and a more holistic understanding of the resource. Key concepts of ecological soil management include protecting soil habitat; managing more by disturbing less; keeping soil covered, diversifying food and carbon sources for soil microorganisms; diversifying plant and animal diversity; and growing roots throughout the year (Archuleta, 2012; USDA-NRCS Soil Health Principles). Additionally, holistic soil management requires a balanced approach to building and enhancing soil's physical, chemical, and biological properties. Within this context, we underscored the importance of seeing ecological soil management as a balance sheet where deposits and withdrawals affect the health and direction of a soil's health and ability to function.

With this background, a key soil health management strategy was on using cover cropping systems and other soil health building strategies that would provide benefits to enhance the physical, chemical, and biological properties of soils in intensive commercial vegetable production. The outreach emphasis and target audience was small and mid-size farms that have transitioned to more wholesale level vegetable farming in the Shenandoah Valley and Northern Piedmont Regions. Education and outreach across the two regions featured summer and winter annual cover crops to prevent runoff and leaching. For farmers who have transitioned to wholesale vegetable production from other types of farming, sound

ecological soil management to prevent soil loss and build soil health can be a challenge. Plasticulture with tillage is a standard and predominant production method, yet from a water quality and soil health framework, vegetable production under plastic can present an ecological risk due to increased impervious surface and exposure of soils to wind and water erosion during field and planting preparation. This management challenge is more evident and a growing trend as more land is tilled and brought into production for vegetable farming to meet demand for local foods. The challenge and trend highlighted a need for additional education and outreach on reduced tillage and cover cropping options that fit cash crop rotations and sequencing of commercial vegetable enterprises. The on-farm demonstrations and farmer testimonials for our Conservation Innovation Grant specifically focused on small and mid-size commercial level vegetable farms serving direct-to-consumer, intermediated, and wholesale markets in the Shenandoah Valley and Northern Piedmont regions.

The train-the-trainer curricular materials targeted core soil health principles to provide in-depth to intermediate knowledge and skills for behavioral change among the farming and conservation community. Knowing people's time and attention spans are at a premium, we wanted the train-the-trainer materials to be robust and adaptable to serve as foundational content that could be readily incorporated into continuing education workshops and on-farm programs for crop and soil science professionals. Farmer-to-farmer learning as peers and mentors is a critical feature of participatory-based education and outreach. Therefore, we wanted on-farm educational exchanges and interactive case studies that allowed farmers with different backgrounds and experience levels to share their conservation ethos and how they are building healthy soils and farms to be central to the grant's educational objectives.

Methods

We utilized a multi-pronged participatory approach to soil health education and outreach programming to build and find broader common ground. The approach was farmer-oriented and more field based to encourage peer-to-peer learning of foundational soil health principles and innovative practices to appeal to beginning farmers, experienced farmers, crop advisors, and agency personnel. The project team tested and proved the value of their educational recommendations by integrating many of the recommendations into the educational events they conducted. Nearly every one of the project's soil health events or presentations featured at least one hands-on soil health demonstration or one practical soil health on-farm case study, delivered either in person or via video.

The project was innovative in a number of ways. The curricular train-the-trainer materials developed (i.e., videos, technical clips, handouts, and six modular-type PowerPoint® presentations) can be adapted to different audiences (e.g., beginning and emerging farmers, experienced established farmers, Extension educators, USDA professionals, technical service provider and people just generally interested in soil health and what farmers are doing to protect the environment) and training venues. The five cooperating farms enlisted for on-farm demonstrations varied in size and farming history to include: a farm that grew from a backyard garden to a Community Supported Agriculture (CSA) to a 12-acre market garden service to Washington, D.C public schools; a traditional dairy farm venturing into 20-acres of vegetable production to support an on-farm roadside stand; an educational farm developed to utilize land given to a county, which now serves as a research and demonstration site while also providing fresh produce to area food pantries; a 40-year old 30-acre sustainably-based

commercial vegetable farm serving direct-to-consumer markets in Loudoun County and Northern Virginia markets; and a 12-acre leased vegetable farm that specializes in community supported agriculture (CSA) and are vendors at multiple farmers markets in the Washington, DC Metropolitan Area. The on-farm demonstrations utilized reduced tillage and planting equipment that was a) not readily or easily available in the region; b) scaled to small and mid-sized farm operations; and c) considered the horsepower limitations of tractors generally used in the region. The USDA-NRCS Rainfall Simulator was demonstrated to farmers within a conservative Old Order Mennonite community as part of the Shenandoah Valley Produce Auction's Annual Member Business Meeting.

The S & S Marketing Lift N' Till strip zone tillage equipment and a Monosem Two Row Planter were used as innovative soil conservation tillage and planting technologies for field demonstrations on commercial vegetable operations in these regions. These two pieces of equipment were selected for several reasons. The equipment and planting technology was not available regionally when the project started and not scaled for Virginia's typical small and mid-sized commercial vegetable farms. The planter was able to handle seeds as small as radishes and as large as pumpkins and beans. The planter technology gave cooperating farmers more flexibility to consider cover crop sequencing based on their particular cash crop needs. The narrow strip zone tillage equipment was sized to accommodate the range of horsepower available on tractors typically used in the regions. Use of cover crops and no-till cover cropping systems in commercial vegetable farm operations was less common in the region, the cooperating farmers were less familiar with the soil conservation technology but very interested in demonstrating and experimenting with the technologies and fitting cover cropping into their systems.





Figure 4. David Sours of Public House Produce explaining how the Monosem Two Planter and Lift N' Till strip zone tillage implement works at recent USDA-NRCS CIG Showcase. Photo credit: Virginia Cooperative Extension.

Quality Assurance

The six modular PowerPoint® presentations developed as train-the-trainer curricular materials were created by Virginia Tech and USDA-NRCS personnel and were reviewed by peers with the university and agency. Two USDA books, *Building Soils for Better Crops* and *Managing Cover Crops Profitably*, were utilized in trainings and in the development of the PowerPoint® presentations because the books were authored by faculty of two Land Grant Universities and endorsed by USDA. The books were distributed as foundational resources for ecological soil management (Magdoff & Van Es, 2009; Clark, 2012) at soil health trainings. Additional materials and educational resources were gathered and curated from USDA-NRCS, research and extension publications of Land Grant Universities, peer reviewed soil science publications, and some trade publications. Videos with farmer testimonials and case studies were collected and added to the training material because innovative farmers like Gabe Brown, Dave Brandt, Alex Hitt, and others are out front of the research and extension community on many soil health topics.

Regarding the development of the videos and technical clips, Virginia Tech consulted with Virginia USDA-NRCS personnel to determine to contract with professional videographers (AE Media) for the work. Although some members of the grant project team have rudimentary videography skills and some knowledge of Camtasia software, everyone agreed it would be better to work on a contractual basis rather than rely on internal videography resources from Virginia Tech and Virginia USDA-NRCS. Similarly, as the video work progressed and the quality of the educational materials became apparent after completion of the first set of videos, Virginia Tech and Virginia USDA-NRCS collaboratively decided to devote more time and resources into developing more videos as a means of education and continued outreach.

An S & S Marketing Lift N' Till strip zone attachment (Specialty Sales, Sumner, GA) and Monosem Two Row Planter with a Yetter Coulter (Monosem Inc., Lenexa, KS) were purchased with Conservation Innovation Grant (CIG) funds for on-farm demonstrations. The equipment purchases were based on the recommendations of Allen Straw, Extension Specialist and Dr. Ron Morse, Emeritus Associate Professor of Virginia Tech's Department of Horticulture based on their long experience with commercial vegetable production.

The CIG project targeted the Shenandoah Valley and Northern Piedmont regions, but also reached into Loudoun County and Northern Virginia counties. All of the educational programs were open to all Virginians and promoted across the state.

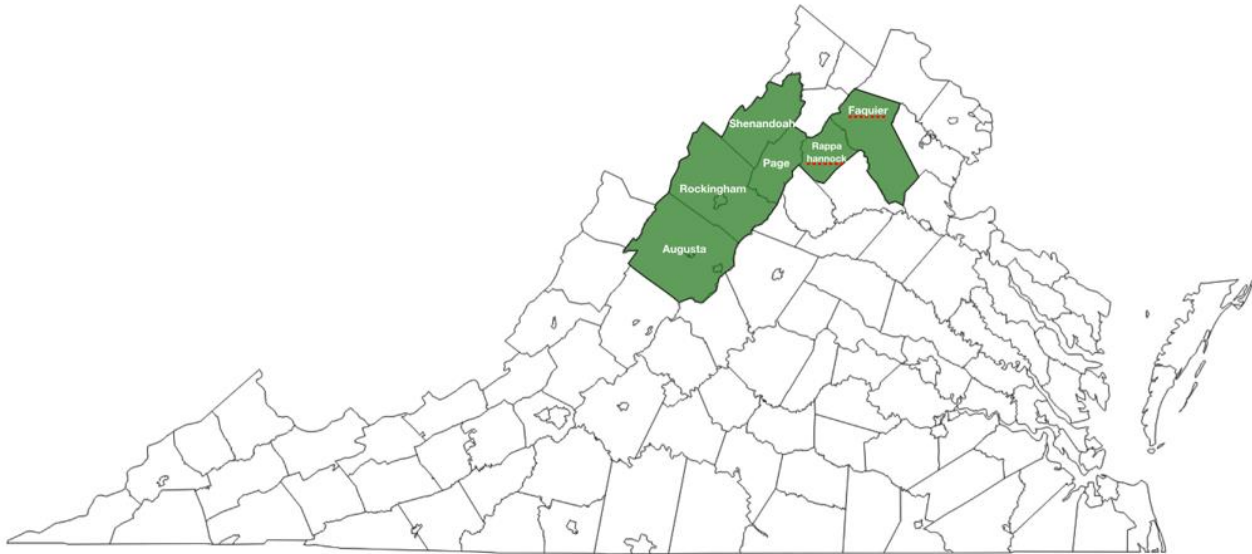


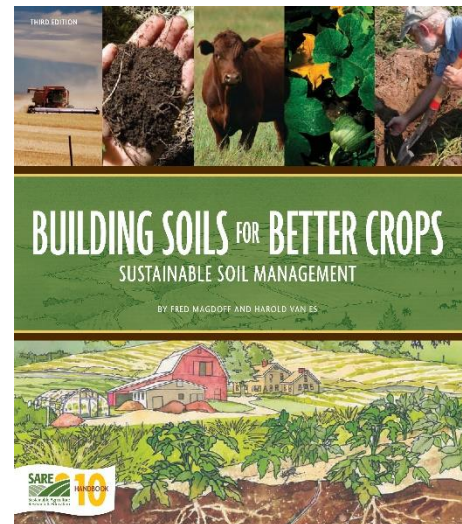
Figure 5. Geographic focus area of the Conservation Innovation Grant.

Findings

The fundamental project goal was to ensure that key Virginia partners, including NRCS, Land Grant and Extension institutions, other agencies within the agricultural and conservation, and a broad range of farmers, find and stand on “common ground” with respect to soil health principles and concepts. The objective of providing train-the-trainer educational materials as part of an intermediate level curriculum was modified as the project developed. The project team and Virginia NRCS personnel realized that good educational materials such as *Building Soils for Better Crops* (Magdoff & Van Es, 2009) to serve as a basis for soil health training and outreach already exist, but sometimes are underutilized as a training tool. We concluded any Virginia soil health curriculum and training should use *Building Soils for Better Crops* as a foundational resource because it is a widely respected textbook authored by two faculty of land grant universities and endorsed by USDA. The book serves as a handy classroom resource and can be a key reference resource for students and professionals who want to dig deeper into other soil health topics or just want to quickly review key principles.

Virginia NRCS has effectively summarized soil health management into the four principles: 1) Keep soil covered, 2) Minimize soil disturbance, 3) Maximize living roots, and 4) Energize with diversity. These principles complement the textbook very well and condense the core recommendations from *Building Soils for Better Crops* into twelve words.

A key finding applicable to soil health instructors is to avoid “reinventing the wheel” by creating extensive custom handouts on soil health. *Building Soils for Better Crops* is a reliable resource and textbook, if needed, instructors can adjust their teaching to the textbook. Instructors do not need to write a new textbook to match their teaching emphasis. The project team concluded there is not a single soil health class agenda or PowerPoint® slide set appropriate for all teaching or field situations. Instructors must adapt their teaching strategy, lecture materials, demos and case studies to the target audience, event, and context.



An effective soil health educational program should emphasize hands-on soil demonstrations and farmer case studies. The recommended strategy is to present core soil health concepts and principles, and use demonstrations such as the table-top aggregate stability test or outdoor rainfall simulator to illustrate and reinforce the concepts. Farmer case studies -- ideally presented by farmers themselves -- are crucial for showing how soil health concepts can be applied to practical, real-world situations. Therefore, we tried to optimize face-to-face training opportunities and peer-to-peer networking of farmers as well as agency personnel and Extension educators. The modification was based on opportunities that emerged to work with cooperating farmers who could articulate core soil health principles succinctly and share their life experiences of building soil health on their farms at educational events and through video materials (e.g., Ellen Polishuk of Potomac Vegetable Farms, Jim Hankins of Fauquier Education Farm, and Rachel Bynum of Waterpenny Farm).

This slight modification of objectives was done to focus specifically on farmers’ experiences and to extend the opportunity for continued learning beyond the length of the grant period. Towards this goal, Virginia Cooperative Extension worked in collaboration with USDA-NRCS, AE media, and three cooperating farmers to produce and publish 11 soil health videos and technical clips to expand the scope and outreach of training materials. This outreach method resulted in 16, 484 online views of the educational videos from December 2015 to July 2017. The videos can be accessed from Virginia USDA-NRCS’s YouTube Channel and Virginia Cooperative Extension’s Soil Health and Cover Crops topic page at <https://ext.vt.edu/agriculture/soil-health.html>.

[Experiments with No-Till Cover Crops at Potomac Vegetable Farms](#) (1,730 views 7/10/2017)

[Fine-Tuning Fertility at Potomac Vegetable Farms](#) (110 views)

[Flail Mowing Cover Crops at Potomac Vegetable Farms](#) (890 views)

[Growing Money and Soil at Potomac Vegetable Farms](#) (2,310 views)

[Hay Mulch for Vegetables and Soil at Potomac Vegetable Farms](#) (3,251 views)

[Intensive Composting at Potomac Vegetable Farms](#) (1,086 views)

- [No-Till Vegetable Experiments at Fauquier Education Farm](#) (478 views)
- [Overseeding Cover Crops into Fall Vegetables at Potomac Vegetable Farms](#) (3,879 views)
- [Soil Spading for Gentle Tillage at Potomac Vegetable Farms](#) (1,194 views)
- [Starting with Soil at Waterpenny Farm](#) (727 views)
- [The “Vacation Year” Cover Crop Rotation at Potomac Vegetable Farms](#) (829 views)

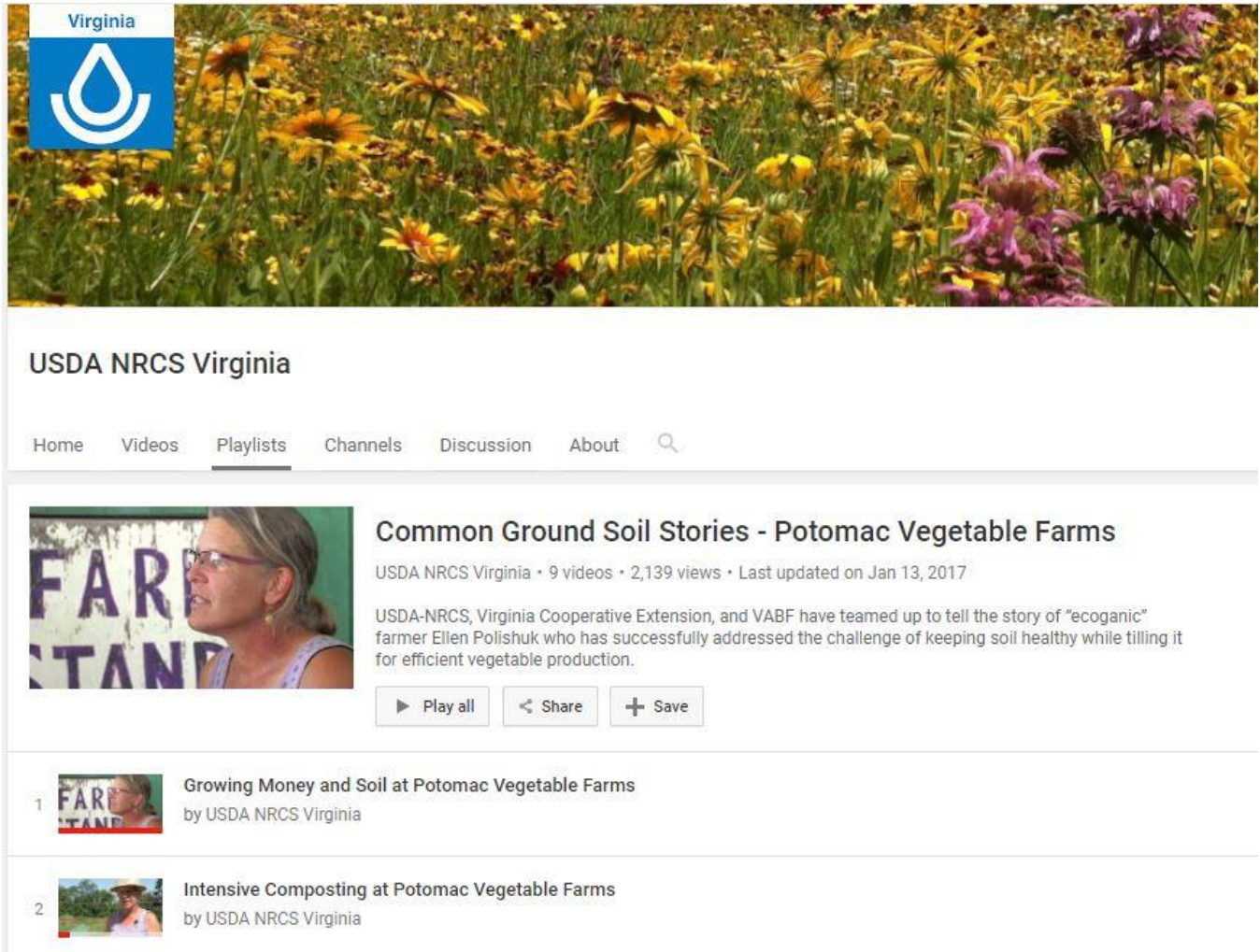


Figure 6. USDA-NRCS Virginia's YouTube Channel and Common Ground Soil Stories.

The curricular train-the-trainer materials developed (i.e., videos, technical clips, handouts, and 6 modular-type PowerPoint® presentations) can be adapted to different audiences and training venues such as beginning and emerging experience farmers, established farmers, Extension educators, USDA professionals, technical service provider and people just generally interested in soil health and what farmers are doing to protect the environment) and training venues.

Of course, the cooperating farmers experienced obstacles and faced a learning curve as they tried to integrate cover crops into their existing cropping systems. For example, cover crop residue management was a challenge for David Sours of Public House Produce. David planted a cover crop mixture of rye, clover, and hair vetch in the first year of the grant. Dealing with the hairy vetch was particularly problematic and clogged David’s planting equipment as he tried to plant into the residue

so it was very frustrating in what crops worked and what did not work for his systems. As the project progressed, David was able to gain a better handle on rolling and crimping of cover crops that worked in his system and when the best time to terminate the cover crops ahead of planting. Additionally, the cooperating farmers had concerns about disease, pests (i.e., slugs), equipment needs, and crop sequencing to fit their operations and available equipment resources.



Figure 7. David Sours of Public House Produce partnered with Virginia USDA-NRCS to use roll and crimp his cover crops as part of the on-farm demonstration effort.

Although we did not track economic results specifically, the statement below is from David Sours, a Page County cooperating farmer, based on his experience with this conservation innovation grant.

“I would never have invested in the equipment to try out a new tillage system without this Conservation Innovation Grant and the partnership project with Virginia Tech and NRCS. Would I buy it today? Probably so. We’re grossing less than we did a few years ago but netting much more.” – David Sours, Page County produce grower.



For another cooperating farmer, Ellen Polishuk of Potomac Vegetable Farms, the innovative approach and discussion of cover cropping allowed her to address a misperception she had about no-till cover cropping. Even though she is an experienced vegetable farmer and advocate for ecological practices, she perceived that no-till cover cropping automatically meant the use of herbicides to terminate the crop. During the course of the grant project, USDA-NRCS and Virginia Tech were able to work with Ellen to design a no-till cover cropping experiment for her cropping system to dispel this misperception and show her no-till is possible without herbicides. Follow the following link to hear Ellen Polishuk describe her misperceptions and the [Experiments with No-Till Cover Crops at Potomac Vegetable Farms](#) (1,730 views 7/10/2017).

The educational programming associated with the grant and soil health team-building involved significant hours of instruction, outreach, and continuing education credits to soil health educators, trainers, and practitioners. The videos and technical clips were incorporated into 2015 and 2016 training events including JED training sessions. Cooperating farmers were also enlisted as speakers and panelists at the training events to talk about their own practical soil health applications as Virginia’s Soil Health Champions. The table below outlines 23 grant-associated soil health educational programming events.

Year	Event	Location (county)	Description	Speaker	Soil Demo or Farmer Case Study	Approx. hours instruction	Approx. audience size
2013	Vegetable Production & Water Quality Meeting	Page	Rainfall simulator demo at on-farm event	Project team	Yes	1	35
2013	Farm to Table Conference	Augusta	Soil health management case study and presentation	Farmer Gabe Brown	Yes	1	200
2014	Vegetable Production School	Rappahannock	On-farm soil health discussion and event	Project team and Rachel Bynum and Eric Placksin	Yes	1	32
2014	Farm-To-Table Conference	Augusta	Soil biology seminar	Dr. Elaine Ingham, farmers, project team	Yes	6	430
2014	Farm-To-Table Conference	Petersburg (VSU)	Soil biology seminar	Dr. Elaine Ingham, farmers, project team	Yes	6	200
2015	Vegetable Production School	Rappahannock	On-farm cover crop demonstration and training about pollinators	Project team and Rachel Bynum and Eric Placksin	Yes	1	28

2015	VCE Winter Vegetable School	Fauquier	Soil health presentation	Project team	Yes	1	45
2015	VCE Winter Vegetable School	Rockingham	Soil health presentation	Project team	Yes	1	40
2016	Farm to Table Conference	Augusta	Polishuk CIG project soil health video screening	Farmer Ellen Polishuk (via video)	Yes	0.25	200
2015	Farm to Table Conf.	Augusta	Soil health presentation	Farmer Ellen Polishuk	Yes	1	35
2015	Farm to Table Conf.	Augusta	Soil health presentation	Farmer C.J. Isbell	Yes	1	35
2015	Farm to Table Conf.	Augusta	Soil biology panel session	Dr. Mike Strickland, Mark Schonbeck, farmer Bill Cox	Yes	1.5	35
2016	Soil Health Team-Building Workshop	Fauquier	Pilot soil health training for VCE & partners	Project team	Yes	4	25
2016	Fauquier Ed Farm Twilight Tour	Fauquier County	Tour of cover crops and no-till vegetable experiments	Project team	Yes	1	20
2016	Shenandoah Valley Produce Auction Grower Meeting	Rockingham	Rainfall simulator demo and soil health presentation	Project Team	Yes	1	110
2016	Farm to Table Conference	Augusta	Waterpenny CIG project soil health video screening	Farmer Rachel Bynum (via video)	Yes	0.25	200
2016	Farm to Table Conference	Augusta	Soil management presentation	Farmer Alex Hitt	Yes	1	59
2016	Farm to Table Conference	Augusta	Reduced tillage vegetables presentation	Dr. Ron Morse	Yes	1	
2016	Farm to Table Conference	Augusta	Presentation about CIG-funded reduced till and cover crop demonstrations	Project team plus farmers David Sours, Jim Messick, etc.	Yes	1.5	35
2017	Virginia Association for Biological Farming (VABF) Conference	Bath	Polishuk and Waterpenny CIG project soil health videos shown at Conference	Farmers Ellen Polishuk and Rachel Bynum (via video)	Yes	0.5	400
2017	Intro to Soil Health for Urban Famers	Henrico	Pilot soil health training integrating all aspects of project	Project team	Yes	6	20

			team's recommendations				
2017	Fauquier Education Farm twilight tour	Fauquier	Rainfall simulator demo and cover crop field tour	Project team	Yes	2.5	25
June 2017	Reduced Tillage Vegetables: The Potential & The Practical	Page	On-farm meeting and CIG Project Showcase meeting	Farmer David Sours, Allen Straw, and Dr. Wilson	Yes	4	90

An intensive soil biology training was part of the 2014 Virginia Farm-to-Table Conference at Blue Ridge Community College and was attended by more than 230 people. A similar soil biology training at Virginia State University drew 197 participants. The two 6-hour in-depth soil biology trainings at the two sites reached 215 farmers, 87 soil conservationists of Virginia's NRCS field staff; 27 employees from soil and water conservation districts; 36 Extension agents and specialists; and 61 representatives from non-profit organizations. The grant project team worked with Jeff Heatwole, manager of the Shenandoah Valley Produce Auction, to have the USDA-NRCS Rainfall Simulator demonstrated at the Auction's 2016 Annual Business Meeting. The demonstration was viewed by 112 producers within the Mennonite community including youth and women.



Figure 9. Rainfall simulator demonstration at 2013 Vegetable Production and Water Quality meeting in Luray, VA.

Two USDA books, *Building Soils for Better Crops* and *Managing Cover Crops Profitably*, were utilized and shared as foundational resources for ecological soil management (Magdoff & Van Es, 2009; Clark, 2012) at the trainings. Six PowerPoint® presentations were developed as modular curriculum so the

modules can be easily adapted for field and classroom settings. Additionally, the PowerPoint® and curricular material allowed for localized case studies and testimonials featuring farmers presenting their soil health innovations and core practices featured in the videos and technical clips to be easily integrated into training agendas and presentations.

Additional educational outreach and marketing of soil health and ongoing resource conservation work was shared through the following websites, social media platforms, and blog sites:

VCE Soil Health and Cover Crops Topic Page: <http://ext.vt.edu/agriculture/soil-health.html>

VCE Virginia Farm-to-Table Facebook Page: <https://www.facebook.com/virginiafarmtotable/>

VCE Cover Crops and Soil Health Blog: <http://blogs.ext.vt.edu/cover-crops-soil-health/>

VCE Virginia Farm-to-Table Blog: <http://blogs.ext.vt.edu/farm-to-table/>

Conclusions and Recommendations:

Train-the-trainer educational materials were developed in the form of videos, technical clips, handouts, and six modular-type PowerPoint® presentations that could be easily adapted and integrated into field training events. Educational programming and outreach included 23 training events and activities, which accounted for 45+ hours of instruction. Face-to-face soil health instruction reached more than 1,500 people including Extension/USDA professionals and mentor farmer-leaders. A key focus of the project was to capture farmer testimonials as educational tools for extending the learning beyond the length of the grant period. Virginia Cooperative Extension worked with USDA-NRCS, AE Media (professional videographers), and cooperating farmers to produce and publish 11 soil health videos and technical clips. This educational outreach method resulted in 16,484 online views from December 2015 to July 2017.

The collaboration with cooperating farms to implement on-farm demonstrations of cover crops and reduced tillage resulted in several changes in farming practices: 1) increased no-till cover cropping practices; 2) reduced reliance on black plastic as a weed control method on a commercial vegetable operation in Page County; 3) better understanding of how no-till cover crops can be implemented on an 30-acre sustainably-based commercial vegetable farm in Loudoun County without using herbicides; and 4) adoption of a new cover crop rotation and no-till planting of cover crops as part of a soil health building 'vacation year' devoted to cover cropping and a sabbatical rest. The strip zone tillage technology and integration of cover cropping allowed the cooperating Page County vegetable producer to transition from a very labor intensive CSA/Farmers Market direct-to-consumer market channel to a guaranteed wholesale market channel serving the farm-to-school program of D.C Central Kitchen and their efforts to provide fresh vegetables to seven public schools. The change in cover cropping and soil health building practices for this producer resulted in lower labor costs and gross revenue, but greater net profit.

The cooperating farmers experienced obstacles and faced a learning curve as they tried to integrate cover crops into their existing cropping systems. For example, cover crop residue management was a challenge for David Sours of Public House Produce. David planted a cover crop mixture of rye, clover, and hair vetch in the first year of the grant. Dealing with the hairy vetch was particularly problematic and clogged David's planting equipment as he tried to plant into the residue so it was very frustrating in what crops worked and what did not for his systems. As the project progressed, David was able to

gain a better handle on rolling and crimping of cover crops that worked in his system and when the best time to terminate the cover crops ahead of planting. Additionally, the cooperating farmers had concerns about disease, pests (i.e., slugs), equipment needs for strip zone tillage and residue management (e.g. tractor size, gearing, flail mowers, roller-crimper, etc.), and crop sequencing to fit their cash crop operations and available equipment resources.

We recommend commercial vegetable farmers minimize soil disturbance caused with tillage by utilizing available conservation tillage and planting technologies and explore more cover cropping options in their cash crop rotations. With proper preparation and planning, a soil health building 'vacation year' devoted to cover cropping and sabbatical rest can be a good investment and fit a whole farm plan and multi-year cash crop rotation. Virginia USDA-NRCS can continue to help accelerate the adoption of these practices by partnering with Virginia Tech and farmer-leader mentors to demonstrate innovative technologies and emerging equipment that may not be readily available or easily accessible in some farming regions through cost-share or rental agreements.

The overall net outcome of this project was an exceptionally high degree of partnership and consistency in messaging about soil health across the targeted northwest region of Virginia. Notable outcomes included: 1) a flourishing partnership and linkage between NRCS and VCE, which resulted in a better understanding among NRCS and VCE personnel of each organization's priorities and a much stronger relationship between NRCS and the Land Grant University system at multiple levels, 2) NRCS and VCE personnel are far more likely to partner on educational soil health programs today and use similar vocabulary to promote key soil health concepts and principles than they might have prior to this CIG project, and 3) innovative linkages and outreach efforts helped extend VCE and NRCS educational ideas and conservation resources to new audiences to overcome skepticism and misgivings about information from Land Grant Universities and USDA.

In regard to soil health education and outreach, *Building Soils for Better Crops* (Magdoff & Van Es, 2009) should be used as a foundational textbook for any Virginia soil health training and curriculum. The book is thorough in its coverage of core concepts and can serve as a key reference for students who want to dig deeper into more soil health or review key principles from time to time. Effective soil health educational programs should emphasize hands-on soil demonstrations and farmer case studies. The recommended strategy would be to present core soil health concepts and principles, then use demonstrations such as the table-top aggregate stability test or outdoor rainfall simulator to illustrate and reinforce the concepts. Overall, Virginia USDA-NRCS and Virginia Tech should continue to partner to capture testimonials of Virginia farmers and produce videos to expand their educational outreach efforts and peer-to-peer learning.

Appendices

Appendix 1. Key Personnel and Project Management Team

Eric Bendfeldt (Project Director) works as an Extension Specialist for Community Viability with Virginia Cooperative Extension and is based in the Shenandoah Valley region. Eric completed a B.A. in history from James Madison University in 1987. Eric holds a B.S. degree in Crops and Soil Environmental Sciences and M.S. in Forestry from Virginia Tech.

Timothy Mize (Co-PI) is an Extension Agent with Virginia Cooperative Extension for Agriculture and Natural Resources (ANR). He is a Virginia Tech graduate with a BS in Animal Science and is active in the community. Tim's experiences and knowledge of the area and the local agricultural community are invaluable to the ANR program in Fauquier County.

Tim Ohlwiler (Co-PI) is the horticulture extension agent in the Fauquier County Extension Office. He brings a wealth of educational and horticulture experience to this position. Ohlwiler taught 8th grade Agriscience at Taylor and Marshall Middle Schools in Fauquier County. He has a Master's degree in Agricultural and Extension Education and a Bachelor's degree in Horticulture from Utah State University.

Kenner Love (Co-PI) is an extension agent crops and soil sciences based in Rappahannock County and serves the Blue Ridge and Northern Piedmont regions. Kenner holds a master's degree in Public Administration and a bachelor of science from Virginia Tech. Prior to working with Virginia Cooperative Extension, Kenner worked for the local soil and water conservation district.

Jason Cooper (Co-PI) is Agriculture and Natural Resources Extension Agent with Virginia Cooperative Extension in the central Shenandoah Valley. Jason holds a B.S. degree in Horticulture from Virginia Polytechnic Institute and State University, and has 14 years of experience in landscape design and sales.

Beth Sastre (Co-PI) is the commercial horticulturist in the Loudoun County Extension Office. After completed a Bachelor's degree in Agronomy with a minor in Horticulture she completed her Master's degree in Nutrition and Postharvest Physiology from the C.I.A.D.- Sonora, Mex. (Research Center for Food and Development). Beth has experience on bilingual education as well as working in the research area of fruit trees, grapes, vegetables and food safety.

Dr. John Galbraith (Co-PI) received his B.S. in Range and Wildlife Management at Texas Tech University in Lubbock, TX in 1978, and completed a M.S. in Range Science at Texas Tech in 1983 after working as a USDA Range Conservationist for two years. John worked for seven years as a USDA-SCS Soil Scientist in four states and did soil survey work in four other states. John went back to school to complete a Ph.D. in Soil Science at Cornell in 1997 under the employee degree program. John did a post-doc at Cornell and the University of Florida. John began working at Virginia Tech in 1999 and concentrates on soil and wetland science. John is a state certified soil scientist and professional wetland delineator.

Dr. Robert "Bobby" Grisso (Co-PI) is professor of biological systems engineering in Virginia Tech's College of Agriculture and Life Sciences and farm equipment and safety specialist for Virginia Cooperative Extension. Recently, Bobby was named associate director of agriculture and natural resources for Virginia Cooperative Extension. Additionally, he has authored more than 60 scientific publications and more than 100 Extension publications. Grisso earned his bachelor's and master's degrees from Virginia Tech and his Ph.D. from Auburn University. He is a registered professional engineer.

Dr. Kim Niewolny (Co-PD) is an assistant professor at Virginia Tech in the Department of Agriculture and Extension Education. Kim serves as the director for the Virginia Beginning Farmer and Rancher Coalition and a co-principal investigator on the Appalachian Foodshed Project and a long-term multi-state sustainable farming system project. Kim's long-term aim is to build and expand collaborative partnerships among Virginia Cooperative Extension agents, specialists, and agricultural community stakeholders to create a vibrant future for Virginia's farmers.

Additional Collaborators

Dr. Steve Hodges is a professor for soil science and ecology of managed ecosystems within Virginia Tech's Department of Crop and Soil Environmental Sciences. Steve's research program centers on the benefits and services we as a society derive from managed ecosystems, and how our past, present, and future decisions, especially those dealing with land change, affect the supply of those services. Steve is a co-principal investigator for the Virginia Beginning Farmer and Rancher Coalition and Appalachian Foodshed Project. He is the lead in the development of place-based sustainable farming practices for the Coalition.

Jim Hankins is executive director for the Fauquier Education Farm. Before coming to the Fauquier Education Farm, Jim served as an Agriculture Management Agent for the Va. State University Small Farm Outreach Program.

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