

Tuesday, April 3, 2018

Poster location: 1

Graduate Student Grant: GNE14-071

Anthelmintic efficacy of pelleted cranberry leaf powder against experimental *Haemonchus contortus* infection in lambs

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Gastrointestinal nematode (GIN) infections are a major health concern for small ruminant producers in the Northeastern United States, particularly with the emergence of anthelmintic resistance. In search for alternative methods, it has been discovered that some forages containing proanthocyanidins (PAC), suppress GIN infection. The objective of this study was to investigate the anthelmintic efficacy of PAC-containing cranberry vine (CV) in lambs artificially infected with *Haemonchus contortus*. Lambs (n=21) were infected with 10,000 third stage *H. contortus* larvae and were assigned to receive one of three treatments, CV0 (0 g CV, n=7), CV100 (100 g CV, n=7), or CV200 (200 g CV, n=7) for five weeks. Fecal egg counts (FEC) and packed cell volume (PCV) were measured weekly. At the study's conclusion, total worm burden was determined and five adult worms were collected from each lamb and preserved until viewed under scanning (SEM) and transmission electron microscopy (TEM). An increase in FEC over the feeding period was observed in the CV0 and CV100 lambs that did not occur in the CV200 lambs. Although there was a slight reduction in worm burden in CV200 (3335 ± 378) versus CV0 (3908 ± 399), the difference was not significant. Furthermore, there was an increase in PCV over time only in the CV200 lambs. Observations made using SEM and TEM indicate potential effects on the cuticle and feeding ability of the CV200 worms. Preliminary results indicate that CV may have potential as an anti-parasitic against *H. contortus*, warranting further investigations feeding higher quantities of CV.

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Partnership Grant: ONE14-223

Enhancing productivity of sheep through greater access and use of genetically evaluated breeding stock

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Little improvement in the productivity of U.S. sheep has occurred over the last three decades. Selection of sheep based on genetic information increases productivity. Lambs from genetically-evaluated rams gained 4 lbs. over a 120-d representing an increase in revenue of \$650.00 per 100 lambs. To enhance genetic evaluation, the National Sheep Improvement Program (NSIP) adopted the Lambplan genetic evaluation system. Lambplan allows producers faster access to a larger number of economically important traits. Enrollment in NSIP Lambplan in WV and surrounding states is low. Therefore, the potential benefits of Lambplan are unlikely to be realized by producers in this region. To address this problem, we implemented an educational program that included workshops, on-farm visits and guided tutorials to encourage and train producers to make selection decisions based on genetic information. The program also benefitted producers by increasing access to genetically superior animals through supporting the enrollment of flocks in NSIP Lambplan. Over 50 producers and extension agents were trained, six (6) new producers enrolled in Lambplan, and 4 continued to submit performance data after 1 year, with 1 producer enrolling animals that were considered trait leaders. Ten (10) additional producers actively inquired about the process of enrolling flocks and two (2) registered flocks independent of the program. Benefits of this program included increase availability, demand and use of animals with known genetic values. Producers enrolling in Lambplan or purchasing breeding stock based on genetic values also reported increased growth rates and profitability.

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Graduate Student Grant: GNE17-158

Reclamation of Nutrients and Irrigation Waters from Livestock Wastewater

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Disposal of livestock wastewater effluent (LWE) is a costly expense for dairy and hog farmers in New Jersey. LWE contains high levels of orthophosphate (PO₄-P), ammonium (NH₄-N), nitrate (NO₃-N), total suspended solids (TSS), and biochemical oxygen demand

(BOD). These contaminants are regulated by the Clean Water Act, limiting the discharge of untreated LWE into surface water. One approach for disposal of LWE is to release the effluent to the topsoil of crop fields as fertilizer by spraying, a costly addition to farm production costs. This may also contribute to leaching of NO₃-N into groundwater, and erosion and deposition of particulate PO₄-P to surface waters, with negative environmental impacts. This project evaluated a treatment approach for reclaiming LWE using an aerated fluidized bed reactor (aerated-FBR), coupled with constructed wetland treatment (CWT). The first step of the aerated-FBR-CWT process is to precipitate PO₄-P and NH₄-N as struvite (MgNH₄PO₄·6H₂O) fertilizer from LWE using the aerated-FBR. Bench scale tests showed removal of 63-95% dissolved PO₄-P from livestock wastewater, yielding a usable struvite and calcite (CaCO₃) mixed fertilizer. Simultaneous thermal analysis (STA) coupled with Fourier transform infrared (FTIR) spectroscopy for evolved gas analysis (EGA) showed potential for reducing NH₄-N losses, as ammonia gas (NH₃), for solids collected from dairy wastewater. The second treatment step aims to reduce BOD and TSS levels to meet primary wastewater treatment requirements by CWT. Therefore, a combined aerated-FBR-CWT process will improve sustainability and reduce operation costs, by producing fertilizer for livestock feed crops and refurbished water for irrigation.

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Professional Development Project: ENE16-143

Whole Farm Nutrient Mass Balances for Outcome-based Adaptive Management of Nutrients on Dairy Farms

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Sustainable solutions for agriculture and environmental management on dairy farms require improved nutrient use efficiency across the entire farm, both for the animals and the cropland. However, when it comes to whole farm nutrient management, nutrient cycling can be very complex and management tools available to farmers often focus on one aspect of management only (e.g., milk urea nitrogen to evaluate crude protein ration management; corn stalk nitrate test to evaluate nitrogen management for corn, etc.). In an adaptive approach for whole farm nutrient management, records are kept in such a way that one can assess the nutrient status of the whole farm, pinpoint the areas where improvements can be made, and then track the progress of those improvements from year to year. A whole-farm nutrient mass balance (NMB) assessment can help farmers and farm advisors do this effectively and efficiently. Here we present on our ongoing activities with dairy farmers and farm advisors to evaluate whole farm nitrogen, phosphorus, and potassium balances and identify opportunities for improvement over time.

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Graduate Student Grant: GNE14-087

Staphylococcus mastitis, biofilms, and antibiotic resistance: Barriers to milk quality and food safety on artisanal and farmstead cheese producing farms in Vermont

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The primary objective of this research was to quantify the diversity of Staphylococcus bacteria on farms that make artisan cheese and to describe the sources of potential pathogenic and beneficial members of this genus. A total of 1048 staphylococci isolated from different sources on dairy farms were identified to species level. Twenty-seven different Staphylococcus species were detected. Each of the five farms in the study had a unique dominant species. Overall, *S. haemolyticus* was the dominant species (26.5%) of all the isolates. *Staphylococcus aureus*, *S. chromogenes*, and *S. haemolyticus* were the most isolated species from quarter milk. Cow skin was dominated by *S. haemolyticus*, *S. auricularis*, and *S. succinus*. Apart from *S. haemolyticus*, these species were rarely isolated in cow milk. *Staphylococcus xylosus* and *S. equorum* were more likely to be isolated in the environment. All isolates (n=1048) were screened for carriage of *bla*Z and *mecA* antimicrobial resistance genes. These genes (*bla*Z and *mecA*) were identified in 16.1% (n=169) and 0.6% (n=54) of all isolates respectively; carriage of these genes was also species specific, 100% (n=36) of all *S. fleuretii* were *mecA* positive. *mecA* gene was significantly associated with environmental isolates (p=0.02) and farm E (p<0.01). In vitro antibiotic resistance analysis was done on only 562 isolates. All isolates were susceptible to Vancomycin, Gentamycin, and Amoxicillin/ Clavulanic acid, Enrofloxacin, Cephalocin, Penicillin/novobiocine and Ceftiofur. Resistance in other antibiotics varied with highest resistance seen with Penicillin (15.5%) and ampicillin (12.1%). In general, isolates formed more biofilm biomass on hydrophilic compared to hydrophobic surfaces.

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Research & Education Grant: LNE16-351

Developing perennial grain cropping systems and market opportunities in the Northeast

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Perennial small grain crops are a promising option for sustainable agriculture, requiring fewer material and labor inputs while simultaneously providing ecosystem services, such as erosion control and soil health improvement, that are not obtainable from annual crops. The development and optimization of perennial grain cropping systems and their potential end-uses in food products, however, are largely unexplored. This project combines field experiments and on-farm trials that investigate agronomic optimization and ecosystem

services of two promising perennial grain varieties, intermediate wheatgrass cv 'Kernza' (*Thinopyrum intermedium*) and perennial rye cv 'ACE-1' (*Secale cereal x S. montanum*), with exploration of these grains' potential to be marketed as a sustainable ingredient in high-quality baked goods, craft beers, and distilled spirits. Field experiments comparing perennial and annual grain cropping systems show contrasts in biomass and yield productivity, energy and labor demand, weed pressure, and soil health. On-farm trials have demonstrated the potential of these crops while also identifying key differences in their production, such as fertilization requirements and harvest methods, which will inform future research. Nationally, commitments by influential food and beverage companies to utilize perennial grains, followed by the launch of the first commercial food products made with perennial grains, have sparked significant interest from both growers and consumers. These developments highlight both the incredible opportunity for perennial grains to contribute to the sustainability of our food systems and the need for further development of their production, processing, and markets.

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State SARE Project: SNE17-11

Establishing a service provider network for alternative grain crops in Pennsylvania

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Increasing consumer demand for local sources of craft beverages, specialty flours, and organic animal products offers multiple opportunities for Pennsylvania (PA) farmers to supply alternative grain crops and meet local demand for high-value markets. Currently, local supplies of grains for these products are not meeting demand and prices of corn and soy; meanwhile, milk prices are decreasing rapidly, challenging farmers' abilities to profit on PA's main market enterprises. The need for diverse grain-based products across industries allows opportunities for farmers and service providers in different PA growing regions to supply various markets. Despite high interest, information is insufficient and interdisciplinary collaboration is needed to bridge the gaps of knowledge between marketing and production potentials for these crops. This Northeast SARE State Professional Development Project aims to address needs and opportunities associated with alternative grain crop production and marketing by engaging various practitioners who are involved in production, processing, and marketing to strengthen collective knowledge about associated opportunities and challenges for producing alternative grain crops in the region. Two main market assessments will highlight opportunities for education and production, while field demonstration plots with service providers and farmer cooperators throughout PA will address production questions. This project will result in an interdisciplinary network of informed service providers who are prepared to assist farmers, businesses, and consumers address local concerns about alternative grain crops.

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Partnership Grant: ONE16-258

Increasing the viability of heirloom dry bean production in the Northeast

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Dry beans (*Phaseolus vulgaris*) have been grown in the Northeast since the 1800's but currently the demand for heirloom dry beans exceeds the supply. Unlike white cooking beans, heirloom dry beans are challenging to grow locally due to acquisition of high quality seed, adequate stand establishment, disease management, and reaching proper maturity at harvest. Therefore, the project sought to screen heirloom varieties and develop a list of top performing lines for the region; develop optimum planting dates and seeding strategies to obtain adequate plant populations; determine primary pest issues and identify control options, and evaluate biological seed treatments for control of early season diseases. In 2016, trials were established at two Vermont sites to evaluate heirloom varieties, planting dates, seeding rates, seed treatments, and planter types. In addition, fields on six farms were scouted during the growing season to identify disease and insect pests. The project found that Peregrine and Lina Sisco were promising as high yielding varieties and found to be more tolerant to potato leafhopper pressure. Ideal planting dates varied by location and were most influenced by soil temperature at the time of planting. Biological seed treatment appeared to improve plant stands but did not impact yields. While pest pressure was moderate in 2016, several growers experienced yield losses due to diseases originating from purchased seed, indicating a need for farmers to purchase certified seed or test seed for seedborne diseases. Research reports, videos, and a production guide were produced to share results and lessons learned.

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Graduate Student Grant: GNE16-119

Do cover crops stabilize wine grape productivity in a variable climate?

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Planting cover crops has been proposed as an alternative to spraying herbicide for under-vine management in humid, eastern US vineyards. In addition to documented environmental benefits, belowground competition for resources may beneficially reduce excessive vegetative growth that leads to labor-intensive pruning or poor grape quality. This growth reduction could be enhanced by choosing low-vigor rootstocks. However, studies report variability in grapevine response to these practices and without full explorations of competitive mechanisms, these results have limited application. Over the 2017 season in a Pennsylvania vineyard, we examined the below- and aboveground response of Noiret (*Vitis* hybrid) vines to a perennial under-vine cover crop (*Festuca rubra*) when grafted to rootstocks of low vigor [Riparia (*V. riparia*)] or medium vigor [101-14 (*V. riparia x V. rupestris*)]. The 2017 season was wet, with 518 mm of precipitation between May and October in 136 rainfall events (50% of days); consequentially predawn water potentials were

consistently similar between treatments. While the cover crop influenced grapevine fine root distribution and patterns of soil water content, yield was similar amongst treatments, regardless of rootstock vigor (Pcc = 0.70; Proot = 0.53 ; Pccxroot = 0.88). Mechanistic investigations of soil and root microbial communities, root distributions, depth of water uptake, and vine nutrient status will also be discussed. This study suggests that in a wet year and independent of rootstock, cover crops may not detrimentally reduce yield and have potential as an alternative to herbicide applications in humid, eastern vineyards.

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Partnership Grant: ONE14-219

Developing tools to improve communication between farmers and farm workers around fruit farm practices

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Cornell Cooperative Extension of Ulster County and the Cornell Farmworker Program developed and tested a tool that allowed non-Spanish speaking farmers to effectively give instructions for specific production tasks to their Spanish speaking farmworkers. The tool consisted of step-by-step videos of key tasks, in Spanish and English, and field guides, designed for workers with low or no literacy reproducing the key farm production tasks (e.g. pruning, spraying, harvesting) that correspond to the video instructions for in field reference. The pilot process used a set of grape and raspberry production practices where effective communication is critical or miscommunication occurs frequently. The tools were tested with both farmers and farmworkers to ensure that they were understandable, practical and effective. The project is important because successful management of fruit and vegetable farms requires adequate communication between the farmer and the laborer. Much of the agricultural industry in New York relies on migrant labor, mostly of Latin American origin and many of whom comprehend little or no English. Most farmers in the region do not speak Spanish and often find themselves unable to communicate effectively with their workers. In addition, there is not consistency in the labor pool, such that workers trained one year are back on the same type of farm the next year. As a result, directions are misunderstood, leading to incomplete or improperly completed tasks and decreasing overall farm efficiency and profit.

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Farmer Grant: FNE15-825

Alternative growing practices for oyster mushroom cultivation in the Northeast

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The cultivation of oyster mushrooms as a high value, low overhead crop can diversify a farm and draw in new customers. Oyster mushrooms are said to "demand few environmental controls, their fruiting bodies are not often attacked by diseases and pests, and they can be cultivated in a simple and economic way." This project addressed alternative growing practices for oyster mushroom cultivation in the Northeast. Specifically, the study looked at the efficacy of 4 different treatment methods used to prepare straw for oyster colonization: lime, fermentation, wood ash, and pasteurization (as the control). Three trials were done comparing mushroom yields between the four different treatment methods. Straw was treated and inoculated with six different strains of oyster mushrooms over 3 trial runs. For each treatment method, 8 bags weighing 10 lbs were inoculated, incubated for 3 weeks, and then allowed to fruit for 2 months. Harvest weight was recorded over the 2-month period. All four treatment methods produced mushrooms, with lime producing 12% higher yield than pasteurization on average. The average biological efficiency overall was fermentation 18%, wood ash 20%, heat 29%, and lime 41%. A 36-page booklet on oyster mushroom production was created by the project as a resource for people interested in growing oyster mushrooms.

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Partnership Grant: ONE16-278

Organic weed management using chemically and microbially designed compost extracts

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Organic vegetable growers are interested in effective weed management techniques that allow them to reduce the frequency of in-season cultivation to manage weed pressure while, enhancing soil health and crop yields. An experimental and demonstration field trial was established in Kutztown, Pennsylvania in July 2016 to evaluate the effectiveness of chemically- and microbially-designed compost extract (CMD-CE) on weed management in cabbage, lettuce and turnip during the fall season. In a randomized complete block design with four replications, CMD-CE was applied either post-planting or pre- and post-planting and compared to the grower's standard treatment (in-season cultivation). A no treatment control (no cultivation or compost) was included. Results showed that soil bulk density did not vary with treatments but it was lower in lettuce (0.8g/cm³) compared to cabbage (1.07 g/cm³). Penetrometer readings were greater in soils that received compost extract (27.58 cm and 28.75 cm; post-planting and pre- and post-planting, respectively) compared to grower treatment (20.04 cm) in cabbage beds. Weed biomass was reduced by 40% in turnip beds that received compost extract when compared to no treatment and by 19% and 34% compared to grower and no treatment, respectively in lettuce beds. Compost extract applications provided comparable lettuce and turnip yield to the grower's standard method. Applying compost extract was cost effective in the case of turnip followed by lettuce. Project results have been shared with 218 people in person and nearly 100,000 people via social media – Facebook (44k likes), Twitter (48.3k followers), and Instagram (7.5k followers).

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Farmer Grant: FNE15-824

Development of Good Food Farmers Network: A replicable model of farmer-owned joint marketing and sales

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This project convened a group of beginning and experienced farmers to develop a replicable model for farmer-owned, collaborative joint marketing and sales to expand markets and increase overall income for sustainable farm operations. The goal was for this model to be more profitable and accessible than traditional wholesale outlets and less time consuming than selling direct. The project specifically sought to support small-scale and beginning farm businesses, anchored by more established operations. The project began in 2014 with the creation of the shared "Good Food Farmers Network" brand, which was further formalized in 2015 through the creation of Good Food Farmers Network LLC. The project started with six participating farms, a single distribution site, and approximately sixty customers. Each season, the group has significantly adjusted the model. In 2016, they arrived at a system that worked well and this past year, in 2017, they successfully shifted to home delivery and are in the midst of a first season of winter deliveries, making Good Food Farmers Network a year-round operation with over \$100,000 in sales. Development of the Good Food Farmers Network has been a very organic process—slow, thoughtful, reliant, and focused on strengthening the system rather than a quick infusion of outside inputs (i.e. non-farmer capital). The endeavor not only represents a new direct-to-consumer, farmer-controlled model for distribution but also a farmer-owned enterprise from which other ventures can more readily launch or grow, such as equipment sharing, microloans, food access programs, etc.

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Professional Development Project: ENE12-125

Enhancing Cooperative Extension Capacity to Support The Advancement of Adding Value and Direct Marketing by Farmers in the Northeast

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USDA/ERS has reported that the farmer's share of every food consumer's dollar is approximately 23%, the remaining 77% supporting "middlemen" between the farm and the table. Northeastern producers frequently consider direct marketing and adding value to retain a larger portion of revenues on the farm. Because producing and selling value-added items requires different skills-sets than traditional production agriculture, and selling food opens the seller to unique business liability, farmers must receive training, education and support from Extension and other agricultural professionals to effectively establish and manage local food enterprises. This Northeast SARE Professional Development Project provided comprehensive train-the-trainer education to 34 individuals (27 in the target states of PA, MD, and WV, 3 in Tennessee, and 4 in Oregon), empowering trainees to conduct workshops and provide one-to-one consultation for food business start-up. The training program included fifteen field trips, interviewing farmers who successfully add value and market direct, and seven webinars educating about topics addressed by Penn State Extension's "Food for Profit" (FFP) and "Managing Risk for Food Businesses" (MRFB) classes. Eighteen of the thirty-four participating Extension and agricultural professionals pursued apprenticeship with seasoned Food for Profit instructors, assisting in the delivery of six-hour classes (FFP or MRFB) in their counties or regions. Through these apprenticeships (from October 2013 to December 2015), 57 sessions were held. A total of 983 female, new/beginning, and next-generation farmers attended either an FFP or MRFB class at which they learned the realities of food business start-up, management, and the unique risks associated.

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State SARE Project: SNE16-09

On-Farm Direct Marketing SWOT Analysis Training

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New Jersey is the most densely populated state with 8.9 million people living in an area of 7,³54 square miles. In the Northeast region, on-farm direct marketing has evolved to be the main marketing strategy for small to medium farms and often includes activities, festivals and other high visitor volume events. Educational assistance on topics related to risk management, food safety, financial planning, hospitality training, liability strategies, and regulatory compliance are requested from agricultural service providers. A Rutgers University team of 3 agricultural agents and 1 extension specialist trained extension personnel and other agricultural service providers to assist farmers with strength, weakness, opportunity and threat (SWOT) analysis. This was done through a series of 11 farm visits throughout New Jersey. Prior to the farm visits, farmers with direct marketing operations were mailed educational materials and a list of questions. At each visit, the leadership team conducted on-site SWOT analysis with agricultural service providers and the farm manager and followed up with a recommendations report. A bulletin, "SWOT Analysis for On-Farm Direct Operations," was developed for agricultural service providers and farmers as an assessment tool for managing risk and liability issues for direct marketing farms. A classroom training was conducted on May 11, 2017 with 38 agricultural service providers in attendance to complete the training program. Eleven agricultural service providers committed to use the knowledge gained from on-farm trainings and the classroom. Three trainees have held trainings and distributed the SWOT bulletin to 85 farmers. The bulletin is available at http://sare.rutgers.edu/pdfs/SWOT_Toolkit.pdf.

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Professional Development Project: ENE11-121

Development of Extension Programming to Support the Advancement of Agritourism in the Northeast

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Developing an agritourism venture necessitates a shift on farms from a production-centric focus to one that includes service and hospitality. A multistate team of extension faculty created a train-the-trainer curriculum and supporting educational materials to assist Northeast farmers to minimize risk and liability associated with farm visitations, mitigate financial risk through enterprise budgeting, and improve marketing strategies. The team delivered educational content through multi-tiered delivery systems that included 27 workshops, classroom style trainings, and small-group farm assessments throughout the Northeast, as well as 4 nationally advertised webinars reaching 690 agricultural service professionals and 760 farmers. Strong interest in the training program resulted in the presentation and dissemination of materials beyond the Northeast to national audiences through professional meetings. Educational resources included training modules, webinar recordings, fact sheets, corn maze budgeting tool, farm assessment checklists and educational videos found at <http://agritourism.rutgers.edu/training/>. The project team promoted and presented resources through national venues at the National Association of County Agricultural Agents, National Extension Tourism, National Association of Community Development Extension Professionals, and American Society for Horticultural Science. These professional association engagements, coupled with national exposure achieved through project webinars, also resulted in extension professionals from outside the Northeast region requesting the use of curricular materials in Virginia, West Virginia, Indiana and Wisconsin. At least two international requests for information also resulted from Canada and Antigua. The demand for agritourism resources and information remains high within the region's agricultural community and expanded use of materials remains constant among agricultural service providers associated with agritourism.

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Farmer Grant: FNE16-861

Expanding sustainable shellfish aquaculture: Optimizing growth and survival in a bay scallop nursery system

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The shellfish aquaculture industry in the Northeast continues to expand, and many farmers are interested in producing additional species to diversify risk and bring in supplementary revenue. Bay scallop (*Argopecten irradians*) farming has been attempted by many aquaculturists, though given the different physical capabilities and spatial requirements of bay scallops compared to currently aquacultured species, such as oysters, nursery success has been limited. The best nursery and growout techniques will vary in different environments, though research into all phases following the hatchery is necessary to produce bay scallops of a sufficient size to make a viable product. In a 2016 Northeast SARE project, Ward Aquafarms investigated different nursery techniques to optimize bay scallop growth in year one. Using custom designed downweller nursery systems, four different bay scallop stocking densities were evaluated over the entire nursery period, and growth and survival of the bay scallops were calculated for each density every two weeks, in addition to collecting flow rate and food availability data to determine the most efficient stocking density for maximum growth and yield. The floating downweller systems were ideal nurseries for the specific biological requirements of small bay scallops (0.75 mm), as well as being flexible enough to accommodate the production of bay scallops through the size necessary for growout stocking (>20.0 mm). The utilization of augmented flow resulted in limited reductions in microalgae density, high growth rates, and the ability to produce a large number of high quality bay scallop seed for subsequent growout to market size.

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Professional Development Project: ENE16-144

Northeast Cover Crops Council: Building the Network and Online Decision Support Tools

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Cover crops are multi-functional tools that provide numerous ecosystem services and impact on-farm economics, crop productivity, and system resilience to climate change. While there is a long history of cover crop research and extension in the Northeastern U.S., information on cover crop selection and management to maximize the subsequent ecosystem services provided is scattered across institutions. Furthermore, farmers have unique combinations of production goals and constraints and need resources that tailor cover crop selection and management to their needs. To address these concerns, this project formed Northeast Cover Crops Council (NECCC), a multi-state, multi-institutional organization that links states together, defines knowledge gaps, and informs agricultural professionals. NECCC is supporting and encouraging cover crop use through outreach activities including an annual conference, and by serving as a central clearinghouse for cover crop resources and tools in the Northeast. The project is also looking to use data synthesis and meta-analysis to modify several existing cover crop tools and calculators (namely, the Midwest Cover Crops Council [MCCC] online cover crop decision tool) for use in the Northeast. The team will modify the MCCC decision tool for use in each Northeast state and teach ag-service providers how to use it by hosting train-the-trainer events at field days, workshops, and annual NECCC meetings. Ultimately, the ag-service providers will 1) use the tool to tailor cover crop selection and management to the farmer's crop-system needs and constraints, and 2) teach farmers how to use the tool independently to best accomplish their cover crop goals.

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Professional Development Project: ENE15-141

2016 Northeast SARE Regional Cover Crops Training

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Because of strong interest among agricultural service providers for professional development on soil health and cover crops, this project offered a regional conference and follow-up demonstrations and educational activities offered at the state-level. A 13-member planning committee comprised of researchers and educators from around the region developed the agenda for the Regional Northeast SARE Cover Crops for Soil Health Training to include the diverse crops and climates in the region. To ensure diverse regional participation, state-based teams were recruited to attend. Teams included at least one farmer, one NRCS representative, one Extension professional, and a designated team leader. Additional team members included professionals from industry, research, and non-profits. Each team met prior to the event, attended the conference together, and planned follow-up educational activities. The conference was offered on March 29-31, 2016 and included a half-day field tour of USDA ARS projects in Beltsville, MD. 94 participants and 23 speakers attended the training, heard presentations, and engaged in discussion around a range of cover crop topics including species, varieties and mixes, seeding rates and establishment techniques, termination methods and equipment, and fitting cover crops into different crop rotations. Videos and slide presentations were posted: www.sare.org/cover-crops-training. Post-workshop, all 11 teams (RI and CT having a joint team) that attended submitted a plan under a special Northeast SARE Partnership grant initiative and received funding to conduct cover crop demonstration and education activities in all 12 Northeast states. These projects are currently being administered. Follow-up surveys showed significant knowledge gained and farmer adoption.

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Research & Education Grant: LNE14-338

Deep Soil Nitrogen: A Resource for Sustainability in the Mid-Atlantic Using Early Cover crops

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In the mid-Atlantic U.S., summer annual crops are typically grown from May-August, leaving eight months when no crop is taking up soil nitrogen (N). After the annual crop senesces, large pools of N remain in the soil. Through a survey of 29 farms in September, we found an average of 284 kg/ha of mineral N in the soil profile (0-210 cm deep), 76% found deeper than 30 cm. We hypothesized that deep-rooted cover crops planted by early September could capture large amounts of N, and release this N on the soil surface following cover crop termination. We performed experiments on 25 farms across Maryland and Pennsylvania evaluating the following cover crop treatments: 1) forage radish, 2) winter cereal (e.g., cereal rye, triticale, oats), 3) cover crop mix including radish, a winter cereal, and a legume (usually Crimson clover), and 4) no cover crop control. We measured soil N (0-210 cm deep) and cover crop N in November and April. Following cover crop termination, we planted corn on the plots. At the V5 stage, corn following radish had significantly higher biomass than corn following no cover crop or a mixed species cover crop, which had significantly higher biomass than corn following a winter cereal cover crop. Corn following radish, mixed species cover crop, and no-cover crop had higher grain yields than corn following winter cereal cover crops. Planting a deep-rooted cover crop immediately following annual crop senescence may help reduce future fertilizer needs and prevent N from leaching into water bodies.

Poster location: 65

Farmer Grant: FNE17-877

Integrated oyster and littleneck clam aquaculture to increase seafarm yield

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This project tested the feasibility of crop diversification on a subtidal oyster farm through the introduction of little-neck clams (*Mercenaria mercenaria*) as a secondary crop species. Adding clam culture to an existing oyster farm allowed for the utilization of different (and otherwise wasted) vertical space within the footprint of an aquaculture lease, increasing the potential for a higher total farm yield. Subtidal culture of little-neck clams bypasses the inherent drawbacks of traditional inter-tidal clam culture (disturbance of wildlife, conflict with wild-harvest fisheries, aesthetic complaints, and co-option of what has traditionally been a commons) and offers the farmer the benefit of crops with different maturation times and increased resilience to disease and pests. A polyculture of oysters and little-neck clams presents farmers with two-high value crop species that can be sold on the halfshell market.

Poster location: 67

Professional Development Project: ENE13-127

Breaking Barriers: Building Capacity to Provide Tractor Education

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This capacity-building Professional Development project developed and implemented a collaborative model for providing tractor education to aspiring and beginning farmers and farm employees, apprentices and interns. It provided professional development to 43 Northeast service providers to deliver tractor and mechanization education that helps participants gain

practical skills, realistically assess and communicate their equipment needs, and make informed decisions, all of which help improve farmers' efficiency, safety and satisfaction with their businesses. Participants included representatives from Extension, other educational institutions, nonprofits, vocational/technical centers and experienced farmers. Through online learning, hands-on training, and follow-up support, participants gained skills, knowledge and understanding that enabled them to offer effective farm mechanization education for new farmer audiences in the Northeast, which typically includes people who have limited experience with machines and equipment. All 31 people who completed the professional development said it increased their ability to train and evaluate new tractor operators. Participants improved knowledge and skills related to teaching basic operation and maintenance of tractors, implementing adult learning principles and providing advice on mechanization. In the two years following the training, 23 people delivered mechanization and tractor safety, operation and maintenance education and coaching to 463 beginning farmers and farm employees. All 352 who completed follow up evaluation surveys reported improving their knowledge; 342 gained skills; and 302 increased confidence. Additionally, 152 people said participation helped them make decisions about mechanization, and 130 reported implementing changes to farm practices. The project's online Tractor Resource Hub remains available to support educational programming.

Poster location: 68

State SARE Project: SNE11-07

Lasting Impacts of a 2012 SARE Beginning Farmer Professional Development Project in Maine

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A SARE state professional development program designed to increase the ability of individual agricultural service providers (ASPs) to meet the needs of new and beginning farmers sparked the formation of a statewide organization that has had lasting impact on ASP effectiveness and Maine's institutional capacity to serve its newest farmers. In 2012, a two-day program brought together ASPs from across the state to learn about the unique challenges faced by Maine's new and beginning farmers. Participants quickly identified the need to network and coordinate activities among the diverse agencies, non-profits, and for-profits working with these farmers, and to better connect them to existing resources. The Beginning Farmer Resource Network of Maine (BFRN) was initiated six months later with initial coordination provided by the SARE State Coordinator. Leadership later shifted to a rotation of BFRN members. Bimonthly BFRN meetings provide training for and coordination among its members. The BFRN online resource directory helps farmers and ASPs find existing resources on topics such as land access, regulations, and learning how to farm (<https://extension.umaine.edu/beginning-farmer-resource-network/>). The annual BFRN workshop at the Maine Agricultural Trades Show provides three days of educational programming and individual assistance for beginning farmers. BFRN members have sought and received competitive SARE grant funds to provide continuing training for ASPs. Results of a survey and follow-up interviews of ASPs will be presented that document the lasting impacts BFRN has had on their work and beginning farmers in Maine.

Poster location: 72

State Program and Regional PDP: region and SNE13-08

Improving Learning in SARE and Extension Education Programs with Five Best Practices for Adult Learning

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The majority of Extension educators have little knowledge of effective adult education methods as most receive training in their agricultural content area and not in educational methodology. Research indicates that farmers (and other adult learners) are most likely to implement new ideas if they are exposed to discovery learning techniques that tap into prior experiences, and if they are challenged to assess their existing perspectives on subjects. In 2012, the Northeast SARE Professional Development Program (PDP) provided training to state coordinators from adult learning specialist Dr. Sandy Bell from the University of Connecticut on 5 best practices for adult learning and strategies to apply them in sustainable agriculture education. In 2013, the New Hampshire SARE state coordinator provided the same training to 18 UNH Extension educators. The best practices grounded in neuroscience and educational psychology are: 1) provide a safe environment for learning; 2) Uncover and share learners' assumptions, expectations and inferences about the content; 3) Link the content to learners' prior experience; 4) Let learners work together to experiment and solve problems with the content; and 5) Let learners contribute to learning content, process and outcomes. By applying these best practices before, during and after learning events, state coordinators and NH Extension educators have changed how they design and deliver education projects and in response report greater confidence in teaching and greater interaction, co-learning and enjoyment among participants.

Wednesday, April 4, 2018

Poster location: 3

Partnership Grant: ONE14-224

Evaluating the feasibility, effectiveness, and challenges of sprouted grains on grazing dairy farms

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This project evaluated the feasibility and challenges of implementing sprouted fodder on dairy farms. In Study 1, five grains (barley, oats, wheat, rye and triticale) were sprouted for 7 days and analyzed for yield and nutritional content. In Study 2, lactating cows were fed a total mixed ration (TMR) during winter and supplemented with either no fodder or 1.4 kg (DM) of sprouted barley fodder. In Study 3, three case study organic dairies that fed sprouted barley fodder were monitored monthly for 12 months to collect data on feed nutritional analysis, milk production/composition, and management. Data from Studies 1 and 2 were analyzed as a replicated complete block design feeding trial. While barley and oats had the greatest fresh weight in Study 1, oats had the greatest DM yield, and barley had the lowest mold score. In Study 2, milk production, milk fat, BW and BCS were not affected by fodder. Cows fed fodder had greater ($P < 0.05$) milk protein and milk urea N. Income over feed costs favored not feeding fodder except when organic corn prices increased by 50% over those used in the study. In Study 3, labor, cost of production, lack of milk response, barley supply and mold issues resulted in two of the farms discontinuing fodder. There was a slight milk response to fodder in the third farm, probably due to lower forage quality. While fodder may be economical in some instances, in many situations, growing high-quality forage would be more economical.

Poster location: 10

Professional Development Project: ENE14-130

Professional Development Project in Weed and Forage Identification and Management

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Because high quality perennial forages in pastures and hayland are critical to sustaining our livestock agriculture in New England, proper identification and management of both weed and forage species are needed. Weeds in these systems pose important management challenges for livestock farmers as they often compete for both above- and below-ground resources that may reduce forage yields, seasonal pasture distribution, stand life and forage quality. Some weed species can also serve as indicator plants, suggesting mismanagement of pasture and haycrops such as soil compaction, low fertility, and overgrazing. Being able to identify weeds and understanding their biology, as well as understanding forage quality, are key in helping farmers develop effective forage management strategies. However, survey results indicate that New England agriculture service providers lack the proper knowledge, skills, and confidence to identify both weed and forage species, as well as develop appropriate strategies to manage them on our livestock farms. This project has helped Extension educators, USDA NRCS and non-profit personnel throughout New England better identify weed and forage species and study pasture and haycrop management strategies to optimize forage quality on livestock farms. Two in-person field workshops, nine webinars, and a dedicated project website were utilized in training. Participants were expected to conduct a self-study of assigned forage and/or weed species and develop management "help" factsheets. Participants were also expected to conduct a farmer educational activity (e.g., workshop, field day, video, etc.) to solidify their knowledge, skill, and confidence levels in weed and forage crop identification and management.

Poster location: 12

Graduate Student Grant: GNE16-123

Sustainable year-round sheep milking management

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Highly-valued cheese and yogurt products are made from sheep milk, with most originating from Europe. Due to limitations on imports, dairy sheep in the U.S. are highly inbred and farmers milk them in one group lactation of 180 days or fewer per year. In October 2016, we began testing an innovative model for sheep milk and lamb production with non-dairy ewes milked in short, frequent lactations with the lambs raised artificially on cold-milk. In our sixth 73-day lactation group, milk production per day is about the same as that of dairy sheep during early lactation. Health, fertility, and lamb survival have been excellent, and we are able to make inferences about optimal nutrient levels in diets for high producing ewes, as well as optimal out-of-season breeding strategies.

Poster location: 13

Research & Education Grant: LNE15-341

Quantifying and demonstrating scrubbing H₂S from farm-based anaerobic digestion systems

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Hydrogen Sulfide (H₂S) is a corrosive and toxic trace gas present in methane-enriched biogas produced from anaerobic digestion systems. When the biogas from anaerobic digestion is used for energy production, the H₂S in the biogas stream must be removed to reduce generator maintenance costs. This study was conducted to thoroughly understand the optimal H₂S scrubbing operational and maintenance parameters, quantifiable advantages and disadvantages of different types of scrubbing systems, and the capital and operational costs associated with H₂S scrubbers. H₂S, CO₂, O₂ and CH₄ concentrations in the biogas were quantified on existing H₂S scrubbing systems (iron-oxide scrubber and air injection) on two farms in Maryland and Pennsylvania. The biogas data has been collected for 6 months on both the farms during this period using two custom assembled continuous biogas monitoring/data recording systems. On one of the farms, air was injected into the headspace and the average H₂S concentration (1938 ± 23 ppm), CH₄ (56.2 ± 0.1%) and O₂ concentration (0.030 ± 0.004 %) were determined. The variability in H₂S concentration correlated with the quantity of air injected into the digester. On the other farm, H₂S concentrations in the pre-scrubbed (715 ± 58 ppm) and post-scrubbed biogas (695 ± 58 ppm), with an average CH₄ concentration of 66.2 % was observed, due to the iron oxide media being saturated. Changing the media led to observable differences in the post scrubber H₂S concentrations, which will be presented at the conference along with financial data on capital costs and on-going maintenance.

Poster location: 14

Graduate Student Grant: GNE17-159

Insect larvae production on dairy cow manure: a potential windfall for dairy farmers and sustainable aquaculture

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Developing methods to recycle and repurpose agricultural waste products is a powerful way of improving sustainability and profitability. This project seeks to convert the waste products of one agricultural sector (dairy farming) into much-needed feed ingredients for another (aquaculture). Historically, fishmeal has been an excellent, although unsustainable, source of protein for farm- and hatchery-raised fish. To reduce feed costs and improve the sustainability of aquaculture, alternative sources of high-quality protein must be developed. Insect meal (IM) is a promising alternative to conventional fish feed ingredients: easy to produce, high in protein and fat, and possessing a favorable amino acid profile. Our project aims at exploiting a plentiful local resource, dairy cow manure, to raise insect larvae as a source of protein for fish. Housefly larvae (*Musca domestica*) were raised on dairy cow manure. The larvae were then processed into an IM that was included in diets for rainbow trout (*Onchorhynchus mykiss*). After 8 weeks, trout fed a diet comprised of 30% IM showed significantly increased growth compared to a control diet based on a typical modern diet. At that time point, samples were collected to evaluate the effects of IM on fish immune health. Assays such as macrophage activity and serum lysozyme activity are currently being performed. These preliminary results suggest that housefly larvae reared on dairy manure are a valuable feed ingredient for trout. This, in turn, will hopefully lead to improved profitability and sustainability of dairy and aquaculture/hatchery operations, reduced environmental impacts, and reduced reliance on fishmeal imports.

Poster location: 15

Professional Development Project: ENE08-108

Sustainable Livestock Mortality Management

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Sustainable livestock mortality management is a critical issue for livestock operators in the Northeast. The Northeast United States has a substantial diversified livestock industry. Many producers are small compared to western standards, but are important to local food production and the overall agricultural system. All livestock and poultry farms have mortalities which must be managed. Sustainable carcass mortality management is a critical issue for livestock and poultry producers to maintain healthy and productive farms. Renderers no longer serve many of the rural areas because of economics. Burying is less appealing because of groundwater contamination concerns and winter burial conditions. Livestock producers were looking for alternative management tools for livestock mortalities. Composting is a sustainable

mortality management tool. Composting of routine and catastrophic mortalities of livestock and poultry has been used successfully. Therefore, for this project, Cooperative Extension and Natural Resource Conservation Service staff received training in proper livestock composting techniques. Three train-the-trainer programs were held in northern New York, Maine, and southeastern Pennsylvania. Fifty-five agriculture service providers participated in trainings, resulting in an additional 51 programs being delivered directly to 2250 producers. From a survey in 2011, 56% of livestock producers use composting as a management tool. This number has continued to increase as a result of continual training and research.

Poster location: 16

Graduate Student Grant: GNE16-128

Early (in-ovo) administration of probiotics to promote growth in broiler chicken

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Increasing concerns over antibiotic use in food animals and the emergence of antibiotic-resistant pathogens resulted in the U.S Food and Drug Administration directive curbing the use of antibiotic growth promoters (AGPs) in poultry production. This has led to an urgent need for safe and natural alternatives to AGPs in promoting poultry health and performance. In this regard, several researchers have demonstrated the efficacy of probiotic supplementation to day-old chicks in improving performance in market birds. However, the period of embryonic growth and immediate post-hatch development account for almost 50% of the productive life of modern broilers. Furthermore, this developmental period is critical to attaining quality broiler performance at marketing. Therefore, in-ovo probiotic administration would provide for an effective means to influence embryogenesis, post-hatch growth, performance and health in chicken. The study investigated the efficacy of in-ovo and in-feed supplementation of probiotics on growth and performance in broiler chicken. We evaluated the probiotic effect on broiler hatchability, growth performance (embryonic and post-hatch), and organ weights by spraying on eggshell and/or in-feed supplementation. In-ovo probiotic application has improved the hatchability and better bone growth post-hatch. In-feed supplementation of probiotics has enhanced the feed conversion ratio, improved body weight, and breast muscle weight gain in chicken. Moreover, in-ovo application of probiotics accompanied with in-feed supplementation has a better effect on growth and development of chicken than either in-feed supplementation or in-ovo application alone.

Poster location: 17

Farmer Grant: FNE15-822

Pastured Rabbit for Profit

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In a 2010 Salon magazine article, locavore kingpin Michael Pollan claimed that raising rabbits made more sense than raising chickens. This project tested this claim by fine-tuning the farm's pastured rabbit operation and using it as the basis for a glass-walls model for other farms. Emphasis was on executing high animal welfare standards, promoting good quality of life standards for the farmers and demonstrating real economic viability for the enterprise. The project revealed that a pasture-based rabbitry can offer a good economic opportunity for the small-scale farmer, given that the following criteria will be met: larger on-farm enterprises exist to help carry overhead costs; the farm is operating year round; quality feed is available at an affordable price; there is consistent access to a legal processor; and regional markets support appropriate pricing and purchase in high enough volume. Farms that may not meet these criteria should not rule out rabbits all together. Starting a small rabbitry is a great way for a new farmer to get some skin in the game while they build the rest of their business. Low start-up costs along with minimal space requirements and light, portable infrastructure make rabbits an ideal starter enterprise, especially for part time farmers without permanent land tenure. The project captured lessons learned through an easily digestible, practical resource for farmers intended to guide them through the start-up phase of their own pastured-rabbit operation. This resource includes a full enterprise budget and rabbit husbandry guidelines.

Poster location: 18

Agroecosystems: LNE16-354

Advancing sustainable cropping systems for dairy in the Northeast

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To enhance dairy farm sustainability in Pennsylvania and the Northeastern U.S., this project evaluated two diverse, six-year no-till crop rotations designed to produce all the feed and forage for a typical-sized Pennsylvania dairy farm. In each 6-year crop rotation, we compared enhanced conservation practices for manure or weed and insect management to

typical no-till Pennsylvania cropping practices for eight years. Using the crop yield and quality results of each year and a dairy nutrition computer model, we simulated milk production and compared the whole farm performance of two cropping scenarios. We also included a typical no-till, corn-soy rotation with pre-emptive insect control practices to help assess efficacy of IPM compared to an insurance-based management of insect pests, not to produce feed for the dairy farm. We evaluated how the enhanced conservation practices have affected soil quality, nutrient dynamics, and weed and insect populations and how the rotations perform fluctuating weather, pest, and market dynamics. Over the past eight years, we made some modifications and the diverse cropping scenarios have produced the majority of the dairy feed and forage, and were profitable. Manure injection conserved more nutrients, required less inorganic nitrogen fertilizer, and maintained similar crop yields. The reduced herbicide practices controlled weeds and maintained crop yield and quality similarly to the standard herbicide system in most crops in most years. Compared to the corn-soy rotation, IPM was successful in maintaining yield while reducing costs associated with insect pest management.

Poster location: 19

Graduate Student Grant: GNE14-080

Integrating no-till and forage radish cover crops for sustainable early sweet corn production

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Fall-planted forage radish (*Raphanus sativus* L.) cover crops have shown successful weed suppression and efficient recycling of fall-captured nutrients. Because cover crop mixtures have been shown to provide additional benefits when compared with radish monoculture, this research evaluated low-residue cover crop mixtures that included forage radish to test feasibility for no-till sweet corn (*Zea mays* L.) production. Treatments included forage radish (FR), oats (*Avena sativa* L.) and forage radish (OFR), a mixture of peas (*Pisum sativum* subsp. *arvense* L.), oats and forage radish (POFR), and no cover crop (local weed population, LW) as the control. Subplots were assigned to supplement nitrogen fertilizer application to sweet corn to evaluate N sufficiency and timing. N treatment included 0 kg N ha⁻¹ as the control, 28 kg N ha⁻¹ at side-dress, and 56 kg N ha⁻¹ with application split between planting and side-dress. Results indicated that these low-residue cover crop mixtures produced more biomass than radish monoculture and yet did not reduce spring soil temperature. Overall, additional 28 kg N ha⁻¹ fertilizer applied at side-dress N yielded the same as 56 kg N ha⁻¹ with application split between planting and side-dress. This indicates that no supplemental N fertilizer is needed at corn planting following these cover crops, notably lowering fertilizer costs. Sweet corn yield and nitrogen release following OFR was more optimal than the other treatments, and therefore could be a feasible cover crop mixture for sustainable production of no-till sweet corn in the Northeast.

Poster location: 32

Partnership Grant: ONE16-281c

Nitrogen contribution from cover crops for vegetable crop uptake

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The goal of this trial was to learn if farmers could provide sufficient nitrogen for their cash crops using leguminous cover crops alone or with reduced nitrogen fertilizers and no additional phosphorus. We planted cover crops on six Massachusetts farms in a completely randomized block design. In early September 2016, plots were seeded using different implements on each farm with the following treatments: 1) No Cover Crop, 2) Rye (70lbs/A) and Vetch (20lbs/A), 3) Farmer Choice. The cover crops were sampled for biomass and incorporated using different implements in late May 2017. Two weeks later each plot was split, with half receiving 60 lbs N/A in the form of Chilean Nitrate and the other half receiving none. Four weeks after incorporation, a cash crop of the farmer's choice was planted on each farm. We sampled soil nitrate 6-12" deep every two weeks beginning on the day of incorporation in late May until eight weeks after in late July. Finally, we measured yield of the cash crop planted into each of these treatments. As a result of the trials, farmer adaptations included: Transplanting most crops four weeks and direct seeding most crops two weeks after cover crop incorporation; experimentation with less nitrogen fertilizer and use of no phosphorus fertilizer in soils with optimum P levels; planting new cover crop mixes including forage radish, crimson clover, and fria annual ryegrass; more soil Nitrate tests to monitor N-dynamics in vegetable fields; and conducting their own and participate in on-farm research.

Poster location: 35

Partnership Grant: ONE16-266

Increasing Profitability of Tomato Production in High Tunnels

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High tunnels allow producers to extend the growing season and increase production of tomatoes for fresh market sales. While tomato is viewed as one of the most profitable crops grown in high tunnels, maximizing yield and quality can lead to even greater profitability. This project looked at three situations where grafted tomatoes could potentially increase profits: 1) improving the fruit quality of the variety 'Big Beef', 2) improving yields of hybrid greenhouse varieties grown in high tunnels with a known soil pathogen, and 3) comparing the yield of grafted and non-grafted greenhouse hybrid varieties with no known soil pathogen problems. 'Big Beef' is a popular variety but often develops yellow shoulders disorder (YSD) reducing overall yields of marketable fruit. YSD is associated with lower potassium levels in the plant and fruit. The research has shown a decrease in the amount of YSD with grafted plants. While, most modern greenhouse varieties of tomatoes have resistance to a wide variety of soil diseases, reduced yields have been reported where soil pathogens are present. Our research was conducted in a high tunnel with a known soil pathogen, *Fusarium oxysporum* which causes Fusarium Wilt. We compared yields of grafted greenhouse variety 'Geronimo' to non-grafted plants. Results showed a significant increase in yield with grafted plants. Research with grafted versus non-grafted hybrid greenhouse varieties was examined to determine if grafting greenhouse varieties were economically viable in high tunnels with no known soil pathogen problems. Results showed little increase in production with these grafted plants.

Poster location: 39

Farmer Grant: FNE15-828

Methods for Improving Quality and Conditions of Ground Cherry Production

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Ground cherries (*Physalis pruinosa*) are highly valued by farmers' market customers, Community Supported Agriculture (CSA) members, and chefs, but it is difficult to meet demand due to the difficulty of harvest. Ground cherries have low, sprawling growth habits and fruit falls off the plants when ripe, requiring harvesters to stay bent over or on hands and knees for long periods, lifting up branches to pick up thousands of tiny fruit. Contact with the ground results in compromised fruit quality and poses a food safety risk. Calliope Farm experimented with pruning, trellising, and grafting ground cherries, in combination with a net catchment system (PTN) to create a more upright growth habit for the plants, and to eliminate fruit contact with the ground. Data on installing infrastructure, yield, harvest time, and fruit quality was collected from Calliope Farm (CF) and the Lower Eastern Shore Research and Education Farm (LESREC), twice weekly from July to September, comparing no-PTN with PTN. Yields from no-PTN were higher at both CF and LESREC by 59.77% and 26.41% respectively; however, PTN reduced harvest time by 62% at CF and by 63% at LESREC. PTN produced larger fruit of higher quality and all farm employees preferred harvesting from the net trough. Discrepancies in yield between the two locations were due, in part, to infestation by three-striped potato beetles at CF. Pruning delayed onset of fruit at both locations and thus delayed yields. Reduced labor and improved fruit quality warrant further experimentation with planting dates in order to encourage earlier yields using PTN.

Poster location: 44

Graduate Student Grant: GNE17-163

Linking adaptive management to climate change impacts on diversified vegetable and berry farms in northern New England

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What information do farmers and outreach professionals need to best support vegetable and berry growers in adapting to the impacts of climate change? Seasoned New England farmers are accustomed to the variable and unpredictable, seasonal weather characteristic of this region. However, the regional climatic forecasts for the next century and coming decades will exacerbate the familiar challenges of variable and extreme weather to a level which significantly threatens the viability of most farms in the region. This project recognizes 1) that farmers are on the front lines of extreme weather and have been actively adapting to the impacts climate change, and 2) that communicating about climatic change is wrought with many challenges. To identify information critical to supporting climate change adaptation and overcome the climate information usability gap, this project focuses on usable, context specific information about the increased incidence of extreme weather. A survey which draws upon the expertise of 250 vegetable and berry farmers identifies: 1) practices already in use to manage for drought and extreme precipitation, 2) promising strategies for managing drought and extreme precipitation at multiple scales, 3) perceived

barriers and tradeoffs associated with these strategies, and 4) preferred networks for learning about innovative management strategies. Results of the study highlight the value of peer networks and knowledge exchange in supporting transitions towards sustainable agriculture and climate resilience. Notable trends in farmers' concerns about site specific vulnerability and uncertainty about climate impacts are matched by the identification of valued resources and critical information gaps.

Poster location: 45

Partnership Grant: ONE13-176

Food storage curriculum for farmers and processors

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Small-scale, distributed food storage is not a well-developed skill set among farmers who often depend on mechanical contractors as expert equipment installers with mixed results. Therefore, this project was conceived to address farmer and processor knowledge gaps in fruit and vegetable storage. The project led to increased postharvest competency and capacity in the region and ultimately improved product quality and farm viability. It has resulted in the development and delivery of a food storage curriculum for farmers and processors that integrated information on crop physiology, optimal storage conditions (temperature and humidity), storage infrastructure (cold rooms, equipment, structure and materials), and controls and monitoring. A total of 337 participants attended in-person workshops totaling 1600 contact hours of educational programming. Meeting and conference presentations combined with webinars brought total participation in structured educational programming to 1122 participants and 2200 contact hours. Evaluation indicated strong, relevant knowledge development with improved understanding of topic and related resources noted among 97% of workshop participants. A web-based clearinghouse of related resources was also developed (<http://blog.uvm.edu/cwcallah/crop-storage-resources/>). The site hosts workshop materials developed under the project, but also collects other existing resources with relevance to the topic. The site saw 18,000 page views over 3 years with an average visit duration of 1.2 minutes. This project coincided with and supported improved direct consultations with 660 producers over 3 years. It increased awareness of the need for additional work in the postharvest arena leading to several other initiatives that will have lasting benefit to the region.

Poster location: 49

Partnership Grant: ONE15-245

Management of soilborne diseases in small farms with eco-friendly treatment options

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Soilborne wilt diseases caused by fungal pathogens, *Verticillium* spp. and *Fusarium* spp. often cause serious economic losses to tomato growers worldwide. This study compared the efficacy of biological control agents (BCA), Serenade and Prestop; bio-fumigants; and grafted transplants with resistant rootstock in suppressing wilt diseases in heirloom tomato cv. 'Mortgage Lifter' in a certified organic production system in West Virginia in 2015 and 2016. Within 60 days after planting, grafted transplants (on resistant rootstock "Maxifort"), biofumigation with mustard cover crop and mustard meal, and BCA treatments showed significantly higher plant vigor compared with non-treated control in the pathogen contaminated soil. All treatments had significantly lower symptomatic leaves than the non-treated check at 35 days after planting except mustard cover crop in 2015. Cumulative harvests for six weeks showed that yield from all treatments except mustard cover crop were significantly ($P < 0.001$) higher compared with non-treated control in 2015. However, 2016 results indicated that mustard cover crop would work best when tissues were well macerated and incorporated immediately in the soil followed by covering with leak proof plastic for up to 10 days. In 2016, all treatments produced higher tomato yield compared to non-treated control. In general, yield advantage over non-treated were in the order of grafted > bio-fumigation > BCA treatments > non-treated check. Grafted plants produced 9.08 and 9.99 kg tomatoes/plant in 2015 and 2016, respectively, compared with only 4.99 kg in non-treated control. Results suggest that BCA, biofumigation, and grafted transplants could be used for sustainable management of soilborne wilt diseases in organic production of tomato.

Poster location: 50

Research & Education Grant: LNE16-353

Development of Disease Management, Fertility, and Weed Control Best Practices for Northeast Garlic Production

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As the number of garlic growers and acreage in garlic have increased, the number of diseases associated with this once trouble-free crop have also increased. Nearly 25% of growers surveyed indicated they have lost 30% or more of their garlic crop at least once in the last five years. To reduce these losses and increase productivity, we developed best practices for garlic in the Northeast through a

series of research trials. Post-harvest trials, a weed control trials, and fertility trials replicated across New York guided the development of these practices. During the grant period, over 1,200 growers attended 19 talks related to this grant. Twelve articles were published, and one of the meetings was covered by a contributor to Vegetable Growers News. Grower actual and planned change with this project has been quite significant. 50 growers (96% of respondents) reported that they will be using soil tests to guide their fertility decisions. Follow-up surveys and individual conversations indicate that yields have been increased by fine-tuning Nitrogen rates on at least 50 acres of garlic. 93% of respondents indicated they understand the importance of creating an optimal drying environment and have long-term plans to do so, and 38% are now growing in warm-air environments to speed the drying process. 43% of growers indicated they are now cutting the tops off garlic in the field. The long-term impacts of these actions and their economic importance will continue to be measured in the coming years, as additional garlic projects continue.

Poster location: 57

Partnership Grant: ONE15-251

Priming for production: A podcast on soil health

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This project set out to create an audio podcast about basic soil science concepts that would be easily accessible to farmers and educators who are often strapped for time, but are able to listen to podcasts while conducting farm work and doing other things. Interest in soil health is increasing, and while there have been extensive efforts to promote the concept of “soil health” along with best management practices, there have not been as many efforts to relay basic knowledge about soil organic matter, the foundation of soil health. This knowledge is especially important in light of how our understanding of soil organic matter has changed in the last decade. Because farmers are often the innovators of new agricultural management practices, increased understanding of basic soil processes may enhance decision-making with respect to developing management practices that increase soil health. As of the conclusion of the project, we produced four episodes of the podcast dedicated entirely to soil organic matter, and have plans to produce more episodes based on interviews that were already conducted. The podcasts are available on the most common podcast platforms, including iTunes and Soundcloud. As educational tools, audio files (podcasts) have great potential for communicating basic science as well as other information and conversations. Like any medium, the material must be compelling and well-presented. The format could use more attention from the agricultural service provider community as a way to reach more people.

Poster location: 58

State SARE Project: SNE15-05/NEUMD14-001

Building Soil Health in Maryland Through Agricultural Service Provider Education

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The Maryland Northeast Sustainable Agriculture and Education Professional Development Program designs and coordinates educational programs for agricultural service providers (ASPs). The presenter conducted a needs assessment to determine a focal topic for a three-year project (FY 2015-2017) and designed a program to address that topic: Soil Health. Project design included a focus on a core group of ASPs who continued their participation throughout the project, with a mix of events targeted at this smaller group and other events open to a larger more casual audience including farmers. The highest rated methods for learning new information indicated by the needs assessment served as the base for this project’s outreach efforts. Project activities included 8 field days and meetings, 1 on-farm demonstration, and 9 webinars and presentations. Tabletop slake demonstrations and rainfall simulations were presented at 7 conference exhibits. These events reached 283 ASPs and 331 farmers. A soil health segment for the popular Maryland Public Television program, “Maryland Farm & Harvest,” was also coordinated and aired. The following performance target outlines the three-year project goals, to be achieved through the above activities. Total outcomes measured after Year 2 are in parentheses. 30 (49) ASPs will incorporate soil health concepts into their current programming and advising, reaching 500 (2,060) producers farming 37,500 (31,060) acres. Of those, 10 ASPs will develop and offer in-depth programming in soil health concepts to their clientele for 150 producers farming 11,250 acres. Verification of third year outcomes is currently underway.

Poster location: 67

State SARE Project: SNE14-13

Social Sustainability on the Farm

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“Social sustainability” is generally defined as “the ability of a social system (in this case, a farm) to function at a defined level of social well-being indefinitely.” Farms face a myriad of social issues both internally (including health and wellbeing,

human resource management, etc.) and externally (interaction with the community). How farm families identify, plan, and manage social sustainability on their farms has significant impacts on the viability of not only their individual farming operations but of their communities as well. From 2011 to 2014, the Vermont state SARE program provided professional development training to increase understanding of social sustainability on the farm among Extension educators and other professionals who work with farmers. Social issues were organized into 5 thematic areas: farm succession, community connections, health and wellbeing, equity, and entrepreneurship. Farm tours were offered that focused on farmers as the training instructors, articulating the importance of social sustainability to their businesses. Seventeen Extension educators formed the core group of participants and a total of 101 service providers and farmers participated in the project. Survey results indicated that 13 of the core educators gained new knowledge regarding social issues that farm families face. Of these respondents, 71% said they implemented changes in their work with farmers to include social sustainability topics as a result of what they learned. As a result, these efforts reached no fewer than 47 farmers; 27 farmers reported a better understanding of social issues and/or reported improvements of social issues on their farms.

Poster location: 69

Research & Education Grant: LNE11-310

Farm Financing: Measuring Profitability and Success

Authors: *Dorothy Suput,¹ Julia Shanks,² Gray Harris,³ Dave Colson,⁴ Mark Canella,⁵ and Chris Lindgren.⁶¹The Carrot Project, Boston, MA; ²Julia Shanks Food Consulting, Cambridge, MA; ³Coastal Enterprises Inc., Brunswick, ME; ⁴MOFGA, Unity, ME; ⁵University of Vermont Extension, Burlington, VT; ⁶North 40, Weston, VT .

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The Carrot Project, and its partners, worked for two years with 23 farmers who desired both business and financial management technical assistance and/or financing. We focused on enterprise development to improve net farm income and help farmers reach their business goals. Each participant was paired with a technical assistance service provider for the duration of the project to track enterprise changes over a two-year period. Important results showed that participating farms had improved financial management skills and an average increase of 52% in net income over two years, and 55% saw a 142% increase in net farm income.

Poster location:

Regional Professional Development Program: region

Northeast SARE State Programs: A Model for Outcome-focused Professional Development

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In 2010, the Northeast SARE Professional Development Program (PDP) began training Extension professionals from each regional land grant university who serve as SARE state coordinators to improve outcomes achieved through their education projects. These coordinators conduct train-the-trainer education for agricultural service providers; however, many have little to no training in assessment of training needs, and effective design, implementation and evaluation of training programs. Workshops were conducted over 4 years at bi-annual meetings by specialists in adult learning, educational program design, and program evaluation on these topics: needs assessment, identifying learning and behavior change outcomes for projects, integrating evaluation throughout planning and implementation, evaluating and reporting outcomes, and best practices for facilitating adult learning. Workshops included a mix of presentations, small group discussions, skill-building exercises, and direct application assignments. Coordinators received instructional guides, resource compilations, planning templates and checklists. Prior learning is reinforced and expanded continually at coordinator meetings. As a result, state coordinator education plans now exhibit compelling needs justifications, logical and clearly articulated intended learning and behavior change outcomes, more engaging educational approaches, and robust evaluation methods and tools. The value extends beyond improved plans – state coordinators are documenting meaningful learning outcomes for their trainees, and strong action outcomes of trainees teaching and advising farmers. The Northeast SARE PDP trainings for state coordinators offer a relevant and effective model for Extension (that could be compressed in time) to give both new and seasoned educators vital but often missing skills to create education programs that deliver and document outcomes.