

The North Central Region-Sustainable Agriculture Research and Education (NCR-SARE) Farmers Forum is an event that gives NCR-SARE grant recipients the chance to share information about sustainable agriculture practices with a regional audience. The talks focus on research, demonstration, and education projects that promote sustainable farming and ranching. The projects emphasize the three pillars of sustainable agriculture: environmental stewardship, profitability, and social responsibility.

This highlight is a summary of reports and presentations from the NCR-SARE Farmers Forums held at the 2016 Kansas Rural Center Farm and Food Conference and the 2017 Illinois Specialty Crops, Agritourism, and Organic Conference. These events featured speakers who received awards from NCR-SARE's grant programs. To read the full reports from these projects, go to the national SARE website at <https://projects.sare.org/search-projects/> and use the project number (e.g., FNC10-809) to read more about the project. View videos of these presentations online www.youtube.com/user/NCRSAREvideo

The next Farmers Forums will be held at the Wisconsin Fresh Fruit and Vegetable Conference in January 2018 and at the 6th Annual Indiana Small Farm Conference in March 2018.

NCR-SARE is a United States Department of Agriculture-National Institute of Food and Agriculture (USDA-NIFA) program that supports and promotes sustainable farming and ranching by offering competitive grants and educational opportunities for farmers and ranchers, researchers, educators, students, institutions, organizations, and others exploring sustainable agriculture. Visit the NCR-SARE website to see a calendar of events, educational resources, grant opportunities, and more at www.northcentralsare.org.

FNC15-1019 Champaign, Illinois – Maggie Wachter

Developing a Method to Capture and Authenticate Single Varietal Honey on Diverse Landscapes

OBJECTIVE: to investigate two related challenges to sustainable beekeeping: pollination techniques that support small-scale agriculture and the authentication of varietal honey.

RESULTS: Between April and May the apple orchards and fields at Curtis Orchard and Pumpkin Patch in Champaign, Illinois boast plenty of blossoms for hungry pollinators. Curtis is part of an Illinois centennial farm, founded in 1873, offering apples, pumpkins, honey, and a variety of agritourism adventures. All fun aside, they're quite serious about sustaining their family farm business, and in 2015 they applied for and received an NCR-SARE Farmer Rancher grant to examine pollination services in their orchards and fields. **The \$11,734 Farmer Rancher grant will allow Curtis Orchard's managing beekeeper, Rachel Coventry, and consulting beekeeper, Maggie Wachter, to investigate best practices for small-scale pollination on the farm. They are also evaluating the honey's pollen content using microscopy.**

"Our research will seek to *think like a bee* to acquire insights into how honey bees might be encouraged to sustainably visit desired nectar sources on small-scale farms," said Wachter. "This research will span two seasons and will investigate pollination techniques that sustain small-scale diversity while providing beekeepers with a method for authenticating varietal honey."

The project is still underway, but by experimenting with variables such as placement of hives, bee population density, and bee variety (Russian vs. Italian) they are already learning about crop pollination and varietal honey production. Early in the project, Wachter and Coventry made an interesting discovery. They thought it would be helpful to move the hives into the apple trees during the bloom, but they noticed that each time the hives were moved, the hives were weakened because many foragers returned to the empty space where the hive once stood.



With support from SARE, Rachel Coventry (left) and Maggie Wachter (right) are experimenting with hive locations, hive population density, honey bee behavior, and honey bee varieties at Curtis Orchard and Pumpkin Patch in Illinois. Photo by Darin Eastburn.

They adjusted their management, and now when they move hives they use a distance of two miles which increases the likelihood of the bees returning to the new hive location. They also plan to double their number of hives, and keep the hives stationary as possible, leaving them in their home apiary near the orchards but not moving them into the apple trees.

By collecting pollen samples from the target blooms and surrounding flora and comparing the samples to types and amounts of pollen found in the corresponding honey using a microscope, they have been able to start a library of common pollen grains found on the farm in order to develop a reference to identify pollen in honey. They intend to develop a guide for the sustainable production of varietal honey to help boost economic return for small-scale beekeepers. Learning to "think like a bee" has its rewards for Curtis Orchard and Pumpkin Patch. They recently won a grand prize in the 2016 International Black Jar Honey Contest put on by the Center for Honeybee Research.

Kearney, Missouri – Thomas Ruggieri Cover Crop-based Reduced Tillage for Fall Production of Cabbage, Cauliflower and Broccoli Using a Roller-Crimper and No-Till Planting Aid

OBJECTIVE: to trial methods of reduced tillage and cover crops for organic vegetable production.

RESULTS: Cover crops can reduce erosion, improve soil health, slow weeds, enhance nutrient and moisture availability, control pests, and offer other benefits to vegetable producers. After vegetable grower, Thomas Ruggieri, planted cover crops on his farm in rural Clay County, Missouri in 2004, he noticed dramatic improvement in soil fertility and plant health. Ruggieri and Rebecca Graff run Fair Share Farm, a diversified vegetable farm with a 140-member CSA in Kansas City. They wondered if they could also use cover crops to minimize labor by reducing the need to hand-mulch crops, and received a \$7,480 NCR-SARE Farmer Rancher grant to conduct a cover crop mulch experiment.

“Summer heat and drought require mulch to conserve moisture, minimize labor associated with weeding, and keep the soil cool,” said Ruggieri. “Growing our mulch in place using reduced tillage methods will save considerable time, energy, and money, while adding fertility to the soil.”

During the course of the project they seeded cover crops, fabricated a no-till planting aid (NTPA), rolled and crimped cover crops, and planted vegetable crops into the rolled beds. They found that it was difficult for rolled/crimped beds to keep weeds smothered during the period between rolldown in late-May and brassica planting in mid to late-July. However, the rolled cover crop beds used for summer tomato planting fared better.

“A comparison between a rolled/crimped bed and one where the cover crop was incorporated and beds hand-mulched showed the latter scenario to produce a significantly higher yielding crop of tomatoes (over 300% difference),” reported Ruggieri.

See photos of their NPTA as well as figures from their planting trials online at https://projects.sare.org/sare_project/fnc14-973/

Evaluating the Roller-Crimper for Cover Crops in Corn and Soybean Terraced Ground

OBJECTIVE: to address questions or problems regarding the operation of a roller-crimper on hilly, terraced, and irregularly shaped ground.

RESULTS: The beauty of the rolling hills in Northwestern Missouri can downright dazzle. But these rolling hills, which captivate with their natural grace, also present a unique set of challenges for the producers who live and work there. Many farmers utilize a practice known as terracing to prevent erosion and surface runoff in their fields. Michael Willis, a farmer in northwest Missouri, says terraces have been important to preventing ditch formation on his farm during the transitional phase from traditional no-till to no-till with cover crops.

Willis owns and farms 64 acres, but he also farms another 1,000 acres of row crops with his family, and helps run his family's 120-head cattle herd. He was curious about the Rodale Institute's cover crop roller-crimper, and wanted to know how effective it could be on the irregular or terraced areas on the farms in his area.

In 2013, Willis applied for and received a \$4,000 NCR-SARE Farmer Rancher grant to evaluate the effectiveness of the Rodale roller-crimper on hilly, terraced, and irregularly shaped fields. With a 15.5' wide roller-crimper hooked onto a LaForge front-mounted three-point hitch and 25 acres of land, Willis commenced his experiment.

Willis' Key Findings for Rolling-Crimping on Terraced or Irregularly-Shaped Fields

- The roller-crimper was able to handle gentle curves, but sharp curves were best treated as corners. Turning too sharply bent the arms of the front-mounted three-point hitch, though they sprung back into place once the roller-crimper was lifted. Willis was concerned that doing this too frequently could break the arms or leave them permanently bent.
- Irregularly shaped fields could be planted while rolling and crimping, but sharper curves still needed to be treated like corners. Willis noted that wide grass borders around the field could make these areas easier to maneuver around, giving ample room to turn around for another pass.
- Rolling and crimping while planting on terraces was easier on straight terraces. Cover crops near the terrace riser were



With SARE support, Michael Willis experimented with cover crops and a roller crimper on his terraced farm in northwest Missouri. Photo courtesy of Michael Willis.

harder to reach due to the concern of hitting the riser with the roller-crimper.

- Cover crop mixes made rolling and crimping more difficult. When certain species of cover crops were ready to crimp, others still needed time to mature. Having a pure stand of one cover crop made it much easier to manage. Planting soybeans into cereal rye was the easiest to manage. In the photo above, Willis is using the roller crimper in cereal rye.
- The roller-crimper did a better job controlling taller cereal rye. Rye in lower fertility areas was shorter and had tougher stems, causing them to spring back up after the roller-crimper rolled over the rye.
- Willis says that he was able to do a pre-emergence application of herbicides even in less-than-ideal field conditions because of the large amount of cover crop biomass—the sprayer did not cut ruts in the field or pick up a significant amount of mud on the tires.

Willis has noticed improvements in soil quality since he started using cover crops. He took a soil active carbon test in 2013 on a field where he planted soybeans into rolled and crimped cereal rye, and it tested .79 grams of active carbon per kilogram of soil. He took a test from the same area in 2014 and it tested .82 grams of active carbon per kilogram of soil.

Economics of Grazing and Haying Cover Crops in North Central Kansas

OBJECTIVE: to compare the economics of three after-wheat cover cropping scenarios in Republic County, Kansas.

RESULTS: Grown on an estimated 10 million acres across the country, cover crops are becoming an indispensable part of crop rotations. To maintain this momentum, the development of reliable information at the local level—how to craft a

diversified rotation that pays—needs to keep pace with growth in farmers’ interest.

That is what motivated Josh Roe to use a \$7,223 NCR-SARE Farmer Rancher grant to explore the economics of grazing and haying cover crops in a corn-soybean-wheat rotation on his family’s farm in North Central Kansas, where no-till is common but cover crops are rare. After one year of trials, Roe has seen many benefits that he likes, from profitability to system flexibility to improved resilience.

“Obviously we’ve been hearing more and more about cover crops. We are familiar with the benefits, especially after wheat, of further utilizing the soil resource and building up organic material,” said Roe, a sixth generation farmer who has 1,500 acres in no-till crop production and backgrounds 3,000 cattle per year. “We were interested in trying them out as part of our rotation.”

Backgrounding is a stage of beef production where excess calves are raised on high quality feeds including grain, forage and pasture.

Working with a Kansas State University agronomist, Roe established a cover crop mix following wheat and compared the economics of three treatments: haying, grazing and terminating the cover crop without incorporating livestock. The cover crop mix included oats, spring field peas, radishes, turnips, and sorghum, except that the hay treatment excluded radishes and turnips.

With high hay prices and particularly favorable weather for cover crop growth in 2014, Roe, an economist by training, used sensitivity analysis to evaluate profitability at various price and yield levels. He harvested 1.59 tons



This cover crop of oats, spring field peas and sorghum was cut for hay in October, yielding 1.59 tons per acre. Kansas farmer Josh Roe compared the economics of growing a cover crop for grazing and hay. Photo by Josh Roe.

per acre and, based on his costs, estimated a break-even point of \$73 per ton, or nearly 20 percent below that season’s price.

“We had very good luck with these trials, good rain, decent hay, and cattle prices,” Roe said. “We realize these results may not be replicable year after year, so we’re going to keep looking at how these systems perform under different conditions.”

There was an immediate soil-health benefit from his trials, too, when a May rainfall of 9 inches in less than two hours caused heavy flooding in the area.

“We still had some flooding, but without the cover crop residue I can’t imagine how bad the erosion would have been—if it had been just bare soil or the previous year’s wheat stubble,” he said.

Going forward, Roe plans to continue using cover crops for both grazing and haying, because the management flexibility it allows is a plus.

“Looking at a combined system like this is interesting,” he said. “Maybe there’s a time you can’t graze because it’s wet and you’re worried about compaction, then you can feed stockpiled forage from another hayed field.”

Roe says there has been a lot of interest in his trials among farmers, Extension agents and county conservation district staff in the area. Along with hosting on-farm field days, he has been asked to speak at numerous events about his experiences with cover crops.

- Story reprinted with permission from Andy Zieminski, SARE Outreach.

The Economic Analysis of Cover Crops, Soil Health, the Role of Livestock and Impact on Moisture

OBJECTIVE: to measure water usage, soil health indicators, and weight gain of cattle in wheat, corn, and soybeans that is drilled or interseeded with cocktail cover crops versus plots without cover crops.

RESULTS: May 2015 was the wettest month in history in the United States according to the National Centers for Environmental Information, and many communities in Nebraska saw record levels of rain and accompanying flooding. In 2014, three farm families in Nebraska and Iowa received a \$22,378 NCR-SARE Farmer Rancher grant to study a variety of economic indicators related to cover crop use on their farms.

At the time that they applied for the grant, they had no way to know that the project would be impacted by the 45” of rain they would receive in 2015. The project did show weight gain in cattle, a slight increase in soil health, and how cover crops mitigated soil loss during intense rains. While the project was inconclusive on cash crop yield gains and water usage, the team was able to document how all that moisture affected their fields and crops:

- Each producer either drilled or interseeded cover crop cocktails into corn and/or soybeans. Barley was drilled in the fall, but the severe winter killed the majority of the stand and the late spring prevented a planting to spring barley, oats, etc. Consequently, the options including grazing were very limited.
- The harvest was late because the weather did not allow crops to appropriately “dry down” in the fields.
- The excessive rains eliminated herbicide residuals. While this enhanced the ability to use different types of cover crops, the excessive weeds made it difficult to interseed and successfully initiate cover crops and fall drilling.
- Harvest generally went to the mid-to-late part of November which prevented drilling in most cases and in turn reduced cover crop options.

Ava, Missouri - Dr. Leo Sharashkin Creating a Depository of Local Honey Bee Strains From Feral Swarms and Demonstrating a Sustainable Beekeeping Model Using Horizontal Hives and Bee-Friendly Management

OBJECTIVE: to develop a turn-key, low-cost solution to starting an apiary.

RESULTS: Nearly 70 percent of all flowering plants depend on bees and other pollinators to reproduce; the fruits and seeds from those plants constitute more than 30 percent of our food and drink, according to The Xerces Society.

Dr. Leo Sharashkin, a beekeeper in Ava, Missouri, says farmers become discouraged from adding bees to their operations due to bee stock issues, costly beekeeping equipment, and complicated management methods.

“Honeybees are extremely beneficial on any farm as pollinators and as producers of honey and wax. The increased production of agricultural crops due to honeybee pollination is estimated at \$19 billion (2010),” explained Sharashkin. “But with only 2.6 million beehives in the US—down from 6 million in the 1940s—up to 70% of honey consumed in the US is imported. Why is not beekeeping more widespread?”

Sharashkin maintains a stationary apiary with more than three dozen hives. He says the apiary was conceived as a model for demonstrating how honeybees could be kept using natural, low-input methods (no drugs, no sugar, no swarm control), with local stock obtained from the wild. **In 2015, he applied for and received a \$7,469 NCR-SARE Farmer Rancher grant to develop and share his solution to starting an apiary based on catching and propagating local bee stock, using bee-friendly, do-it-yourself hive models, and simple, accessible management techniques.** In association with his grant, he posted free information on their website www.horizontalhive.com about catching local swarms and building inexpensive equipment such as swarm traps and horizontal hives. He also published a guide to managing horizontal hives.

“How sought-after this information is can be judged by the following fact: the size of our mailing list at the beginning of the project was under 1,000 subscribers,” said Sharashkin. “In less than two years it increased by more than five times and now represents over 5,000 subscribers from all over the U.S. and even internationally.”

4 Farmers Forum HIGHLIGHT

Building Community and Growing Food with the Next Generation

OBJECTIVE: to transfer sustainable food production skills to lower income youth while building and enhancing community.

RESULTS: Greeting parishioners alongside a church parking lot, a four acre parcel with the accessibility of an urban farm and the mission of a non-profit has been quietly producing and providing food to community members. Sola Gratia Farm is a community-based farm in Urbana, Illinois that is dedicated to producing locally-grown, high-quality, natural produce. The community farm has been committed to helping those who lack access to fresh produce since 2012. With a CSA, a youth day camp, community workshops, and other activities, the farm promotes healthy lifestyles and community building.

In Summer of 2014, Sola Gratia Farm partnered with the Champaign County Farm Bureau and the Champaign Park District to offer a Beginning Farmers day camp for youth aged 6-11. Sola Gratia Farm's portion of the day camp covered basics of vegetable growing, healthy eating, healthy cooking, and beekeeping.

In 2015, Traci Barkley of Sola Gratia Farm received a \$2,000 Youth Educator grant from

NCR-SARE to continue to work with youth, focusing her efforts on developing and building a community garden during after school programming. The work included planning and development of a community vegetable garden. 20-25 students participated in vegetable growing and pollinator work, and learned about vegetable preparation and cooking, soil health, tools, and cultivation techniques.

“This group of kids largely went from disinterest, fear of getting dirty, and general squirrelness to taking ownership in the garden, asking deeper and deeper questions about growing food, and great enthusiasm for every task from planting, weeding, harvesting, mulching, trellising, and especially watering,” said Barkley. “What we feel most proud of was that their concern for having their very public garden ‘messed with’ or ‘stolen from’ turned to a desire to give the produce away to those that need it most or to take home to their families with a genuine sense of pride.”



With support from a SARE grant, Sola Gratia Farm worked with students on the planning and development of a community vegetable garden. Activities included field trips to a farm greenhouse (left) and planting a community garden; the “tomato crew” is pictured above (right). Photos by Traci Barkley.



Missouri beekeeper, Leo Sharashkin, transfers bees from a swarm trap to a horizontal hive. Photo courtesy of Leo Sharashkin.

Tomato Variety Trials for Flavor, Quality, and Agronomic Performance to Increase High-value Direct Marketing Opportunities for Farmers and On-farm Trialing Capacity

OBJECTIVE: to evaluate tomato varieties for agronomic traits, disease resistance, flavor, and quality for local and regional markets in the North Central region.



University of Wisconsin researchers Julie Dawson (left) and Kitt Healy (right) learned that marketable yields for tomatoes were higher in hoop houses.

RESULTS: From farmers markets to sandwich shops, tomatoes have a ubiquitous presence in America's food landscape; in fact, the United States is the second-most leading producer of tomatoes in the world (only China produces more). In terms of annual farm cash receipts, fresh and processed tomatoes account for more than \$2 billion, and tomatoes are the fourth most popular fresh-market vegetable behind potatoes, lettuce, and onions. (USDA-ERS, 2016).

University of Wisconsin (UW)-Madison plant scientist, Julie Dawson, says tomatoes can be a potentially high-return crop for diversified vegetable farmers. In 2014, Dawson received a \$199,866 NCR-SARE Research and Education grant to work with graduate student Kitt Healy to conduct organic and low-input field trials investigating tomato varieties for optimal economic and environmental sustainability on two research stations and six farms. She wants to be able to recommend tomato varieties that have both disease resistance and superior flavor for direct sale to high-value markets in the North Central region.

"Many organic and low-input farmers in the Upper Midwest are using high tunnels (hoop houses) to extend the season for tomato production," said Dawson. "We are using participatory research methods to evaluate tomato varieties for agronomic traits, disease resistance, flavor, and quality for local and regional markets."

The project is on-going, but so far Dawson and her team have started to compare tomato variety performance in high tunnels and open-field management, and have developed a network of farmers who are working to evaluate varieties in on-farm trials. Dawson and her team have also assessed quality and flavor by conducting evaluations with farmers, research staff, and Madison-area chefs, in addition to several public taste tests at field days and other events.

According to Healy, in the 2014 preliminary trials, marketable yield was 20% greater in the hoop house, and in 2015, marketable yield was 45% higher in the hoop house. This difference is most likely due to both an extended season and substantially lower foliar disease incidence in the high tunnel environment.

Dawson says that in addition to their findings on tomato variety performance, they adapted their participatory trialing methodology to more meaningfully involve farmers and other experts in variety trialing research.

"We now have an increasing number of farmers interested in conducting on-farm variety trials and an increasing number of plant breeders working on organic and low input systems wanting to trial their varieties in the upper Midwest with our network," said Dawson.



Tomato varieties were first evaluated by University of Wisconsin research staff after a simple training exercise to score different flavor attributes. These included sweetness, acidity, saltiness, bitterness, and umami (savory taste).

Atwood, Kansas – Chris Sramek

Feasibility, Planning, and Purchase of Mobile Processing Unit (MPU) for Scaling up Free Range Poultry Meat Processing for High Volume Retail Market

OBJECTIVE: to explore the feasibility, design, construction, permitting, siting, startup, and operation of an MPU facility.

RESULTS: Pasture poultry, with its quick turn-around and minimal equipment needs can be attractive to small farmers looking to diversify their farming operations. Chris Sramek is a pasture poultry producer and a member of the High Plains Food Co-op (HPFC); in 2013, customer interest in their poultry was so high that the producer members were unable to keep up with the demand; Sramek says they were limited by processing barriers.

"Pasture poultry producers in the area are at a significant disadvantage when it comes to addressing consumer demand for their locally produced chickens because birds processed on-farm do not qualify for USDA inspected status and there are only two USDA facilities available to the public in the entire 600 mile region between Denver and Kansas City that process poultry," explained Sramek. "For these reasons, sales are limited to direct household consumers and farmers markets while volume markets that make poultry farming more viable are not accessible."

To address these barriers, Sramek applied for and received a \$22,500 NCR-SARE Farmer Rancher grant to plan and construct a Mobile Processing Unit (MPU) to expand processing potential. Their initial design for the MPU was reviewed in 2014, and they received final approval by USDA-FSIS in October 2015. At the time, the USDA-FSIS inspector noted that this was the only federally inspected mobile poultry processing facility in the U.S. The plans developed through the grant can be viewed online at https://projects.sare.org/sare_project/fnc14-978/

"A USDA poultry meat processing facility now exists in Northwest Kansas," remarked Sramek. "This project benefits High Plains' poultry producers by providing a more convenient, efficient, cost effective and easier-to-access option for a federally inspected poultry processing facility in the region."

Development of Cost and Labor Effective Produce Sanitation Methods for Small Farms

OBJECTIVE: to find a way to quickly wash and sanitize ripe produce that minimizes cost and labor and maximizes sanitation.

RESULTS: With programs like Good Agricultural Practices (GAP), Good Handling Practices (GHP), and the Food Safety Modernization Act (FSMA), producers have a more proactive role in minimizing food safety hazards potentially associated with fresh produce. Cucumber producer Carolyn Orr says increasingly, local grocery stores are requiring wash and sanitizing of produce, regardless of farm size. Orr and Mark Straw operate a diversified family farm in Indiana called Strawridge Farm. They recently converted a 10,000 square foot greenhouse into a hydroponic vegetable operation, growing early tomatoes for farmers markets and English (seedless) cucumbers for restaurants through a state-wide distributor.

In 2014, Orr received a \$7,300 NCR-SARE Farmer Rancher grant to evaluate multiple cost and labor effective methods for washing and sanitizing produce that needs gentle handling, like English cucumbers and tomatoes. They developed two different methods for washing and sanitizing that save time, energy, water, and chemical sanitizer. One is a lower tech spray and sanitize system, and the other is a higher tech version that uses a modified commercial cafeteria dishwasher. To evaluate their effectiveness, Dr. Amanda Deering of Purdue and her graduate student, Yoojung Heo, provided bacteriological sampling and analysis.

“The modified dishwasher we designed to wash our produce drastically reduced the time required to wash our produce, which reduced our labor requirements,” said Orr. “It also improved the food safety of our produce, and may do even better with the use of new sanitizers. In the long term, the safety of our produce may be the most important issue for the sustainability of all growers.”

View their plans and information about their designs at https://projects.sare.org/sare_project/FNC14-967/

Marcoot Jersey Creamery Comprehensive Food Safety Program

OBJECTIVE: to initiate a viable food safety program and share the results with other producers.

RESULTS: When the Food Safety Modernization Act (FSMA) was passed in 2011, farmers across the country recognized a need to develop a food safety plan. Marcoot Jersey Creamery in Greenville, Illinois was no exception. In 2013, Marcoot family member, Beth Marcoot, applied for and received a \$7,495 NCR-SARE Farmer Rancher grant to develop a food safety/defense program that could be useful to other producers in the dairy industry.

Marcoot is a seventh generation, grass-based, rotational grazing operation with registered Jersey cattle. John Marcoot had been running the dairy farm since he was 17 years old, but in the mid-2000s his daughters, Amy and Beth, expressed an interest in returning to the farm to start an artisan cheese company. John took over managing the cattle herd, while Amy, Beth, and their mother Linda started working on plans for Marcoot Jersey Creamery. In the summer of 2009, the family started building a processing facility with an on-farm store and educational facility. Their goal was to make and sell farmstead and artisan cheeses solely from the milk produced on Marcoot Jersey Farm. Today, the Marcoots employ more than a dozen people, produce several varieties of cheese, and welcome thousands of visitors to the farmstead each year.

“Assurance that food is safe to eat strengthens consumer confidence and improves quality; both will positively affect income,” said Beth Marcoot. “This also verifies the integrity and commitment of the Marcoot family in meeting our goal to continue to be a sustainable agriculture business for future generations.”

They started their work by gathering information and standards from regulatory agencies and industry associations. They also developed an “excellent” working relationship with their Regional Illinois Department of Public Health inspector. In Phase I, they conducted an analysis of their



With support from an NCR-SARE Farmer Rancher grant, Beth Marcoot and the Marcoot Jersey Creamery in Greenville, Illinois worked to develop and share a food safety program for producers in the dairy industry.

daily routines in food handling. In Phase II, they implemented and evaluated a proactive food safety plan, including a Hazard Analysis Critical Control Points (HACCP) program. In Phase III, they developed a comprehensive employee training program. Finally, in Phase IV, they shared the information they had gathered with others in the dairy industry, so that others could use this information while establishing their own food safety programs.

Their comprehensive food safety plan achieved high scores and certification by a third party audit through AIB International, and they say the plan has contributed to increased productivity on the farm. They are selling more cheese, and they are growing.

“Our dairy herd has increased to keep up the demands,” said Marcoot. “We have increased employees on our farm and creamery. We are confident we provide a high quality product. Our comprehensive food safety/defense program has allowed substantial growth, therefore, assuring sustainability of our family farm.”

The manual that Beth co-wrote with her mother, Linda Marcoot, is called *How to Start a Creamery: Food Safety & Defense Plan*; it covers the basics for producing dairy products, and provides hands-on, step-by-step instructions for developing a food safety program. Access it online for free at https://projects.sare.org/sare_project/fnc13-918/

Apples for Artisanal Cider: Understanding the Characteristics of Single Varietals

OBJECTIVE: to determine which apple varieties will yield high-quality ciders.

RESULTS: In 55 B.C., when the Romans reached England, they noticed villagers drinking an alcoholic apple drink. Many years and pints later, in the United States alone, hard cider production increased from 0.8 million gallons in 2007 to 5.2 million gallons in 2012 (Alcohol and Tobacco Tax and Trade Bureau, 2013).

A couple of the producers who have contributed to that growth are Wisconsinites Marie and Matt Raboin, who made their first few gallons of cider in 2010. They planted their first trees in 2014, and now have more than 1,000 trees, but they reached a barrier in their cider production when they noticed the scarcity of information about specific cider apple qualities. **In 2016, the Raboins received a \$7,500 NCR-SARE Farmer Rancher grant to determine which trees and apples would yield high-quality ciders.**

“For our farm as well as other farms considering a cider-related business, more detailed descriptions of the cider qualities of specific apple varieties will help in determining which trees to plant and how to blend ciders to make artful products,” said Matt Raboin. “Ultimately, we hope that a deeper understanding of cider apple characteristics will lead to enriched experiences of the genetic diversity apples and enhanced community connections to a beverage that is part of our national heritage.”

They purchased fermentation vessels, airlocks, yeast, sanitizer, campden tablets, and other supplies needed for fermenting the ciders. They also purchased supplies for testing the ciders, including a refractometer, a pH meter, and chemical reagents. Then they assembled a collection of English and French cider apples, American heirloom cider apples, American heirloom multi-purpose apples, unique local

apples, and some common eating apples.

They pressed and fermented all of the apples using the same methods (same yeast, same temperature, same yeast nutrients, etc.) to limit variables. Then they tested each juice and recorded specific gravity, total acidity, total tannins, and brix (a measurement of the approximate amount of sugars) for each. Each of the ciders went through a 3-week primary fermentation followed by a 6-week secondary fermentation. All of the ciders were then bottled and pasteurized.

They tasted the finished ciders and evaluated them, recording notes on color, aroma, multiple flavor components, and overall impression.

The project is on-going, but so far, they have conducted fermentation experiments on more than 30 single varietal ciders to determine the cider qualities of each individual apple variety. According to Matt Raboin, the brix of each cider ranged from 10.5 on the low end to 16.3 on the high end. Most of their favorite ciders were those on the higher end of the brix scale.

“There have been a few apples that were clear standouts compared with others and made very enjoyable ciders,” reported Raboin. “Some of our favorites thus far have included Yarrington Mill, Marin Oufroy, Wisconsin Russet, Black Gilliflower, Plumb Cider, and Minkler. This gives us some confidence that these may be apples that we would like to grow more of in the future.”

In addition to reporting at https://projects.sare.org/sare_project/fnc16-1053/, they are actively posting their results on their website www.brixcider.com, where visitors to the website can click on any of the apples they tested for more information.



Marie and Matt Raboin received support from an NCR-SARE Farmer Rancher grant to explore apple varieties for hard cider at Brix Cider in Barneveld, Wisconsin. Photos courtesy of Matt Raboin.



Lawrence, Kansas – Mark Lumpe

Growing Mushrooms on Local Agricultural Byproducts

OBJECTIVE: to set up and test a system where a majority of the mushroom-growing substrate is sourced from participating farms.

RESULTS: Mushroom-growing seems to be increasing in popularity for producers who are looking to diversify their crop production strategy. The value of sales for commercially-grown specialty mushrooms in 2015-2016 totaled \$95 million, an increase of 30 percent from the 2014-2015 season (USDA-NASS, 2016). Wakarusa Valley Farm is a family farm that cultivates organic vegetables, fruits, and mushrooms in Lawrence, Kansas. They wanted to see if they could grow mushroom substrate locally instead of purchasing and shipping their substrate from Colorado, so **Wakarusa farmer, Mark Lumpe, applied for and received an \$11,319 NCR-SARE Farmer Rancher grant to experiment with growing mushroom substrate.** Ultimately, the project team trialed four different mushroom varieties on six different substrate combinations. Their findings favored a sunflower-based substrate grown locally, according to Lumpe, for the following reasons:

- Sunflower was easier to grow to a mature state than corn; it grew well on less fertile soil and responded well to drier conditions.
- Sunflower out-competed weeds better than corn.
- When planted too thickly, sunflower still produced a good crop whereas corn suffered from plantings that were sown too thickly.
- Sunflower heads were easier to harvest than corn ears, from a manual harvest perspective.
- After some experimenting, they found that they could use the entire sunflower head as a mushroom growing substrate by putting it through a small wood chipper.

“We were able to produce the sunflower substrate for 38 cents per pound, a competitive price for substrate,” reported Mark Lumpe. “This substrate is better, cleaner, fresher, and less likely to cause contamination in our cultivation process than the dusty, partially milled shell we had been getting from the mill in Colorado.”

The Viability of Small Scale Aquaponics in Urban and Rural Underserved Communities

OBJECTIVE: to expand Whispering Roots' school-based aquaponics work to include more systems design research, crop growth research, and community engagement.

RESULTS: Combining concepts from both aquaculture and hydroponics, aquaponics systems produce both fish and plants. The practice dates as far back as sixth century China, where duck pens were placed over fish ponds that eventually connected to rice paddies and fields (Tonya Sawyer, 2014). More recently, Nebraska aquaponics expert Greg Fripp has been building closed, recirculating aquaponics systems for small and emerging farms since 1999 with his company Whispering Roots. Using tilapia fish as the foundation of his systems, he has grown and sold several types of lettuce, tomatoes, cucumbers, cabbage, basil, arugula, and other leafy greens.

In addition to producing food, Fripp believes aquaponic systems can help improve education, increase personal income, and develop community-centered solutions to significant economic, nutritional and health disparities. After installing several systems at local schools, Fripp noticed that the ability for communities to grow their own food (including a protein source, such as fish) could be a critical factor in

helping communities become self-sufficient while providing healthy food to their community members.

In 2013, he received a \$2,915 Farmer Rancher grant to expand Whispering Roots' school-based aquaponics work to include more systems design research, crop growth research, and community engagement. For the project, Fripp worked with students and to construct a tilapia-based "flood and drain" system at an Omaha school. In a flood and drain system, a pump is used to flood a growing bed that is placed at a higher level than the fish tank; the water then drains back into the fish tank. With their system, Fripp and the students successfully grew crops such as peppers, eggplant, kale, lettuce, beets, peas, swiss chard, basil, microgreens, and strawberries. They conducted field taste/acceptance tests at local restaurants and grocery stores.

"Multiple tours were conducted and included individuals from urban communities, colleges, universities, and non-profit organizations as well as representatives from rural school districts, state agencies, and visitors from other states," reported Fripp. "The marked increase in aquaponic research projects, home systems, commercial scale, and semi-commercial scale systems is a testament to the importance of this work."

The success of the project contributed to Whispering Roots' award of a \$25,000 grant from the Children's Hospital and Medical Center Preventing Childhood Obesity Grant program to implement the process in several additional communities. Fripp is also engaged in several other community-based aquaponics projects, including the development of a community engagement and training center for Whispering Roots in North Omaha, Nebraska.

"Aquaponics has the potential to provide access to healthy vegetables and fish (protein) to underserved communities at the point of consumption," said Fripp. "Like all farming, there is risk associated with the work and there are no guarantees of success. Interested parties should approach these projects with open minds and good planning to help ensure the greatest likelihood of having a positive outcome."



PHOTO BY GREG FRIPP

With support from NCR-SARE, Greg Fripp worked with students in Omaha, Nebraska to construct an aquaponics system where they grew peppers, eggplant, kale, lettuce, beets, peas, swiss chard, basil, microgreens, and strawberries.

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