

Success in the Field

Accomplishments of Phase II of the
National Strawberry Sustainability Initiative

2014 – 2015



Success in the Field

Accomplishments of Phase II of the National Strawberry Sustainability Initiative

2014 – 2015

Editorial Staff and Contributors

Dr. Curt Rom, Director, CARS, NSSI

Heather Friedrich, Program Manager, NSSI

Luke Freeman, Communications Specialist, NSSI

Jack McCoy, Program Assistant, NSSI

Debby Wechsler, Contributing Author

Bettina Lehovec, Copy Editor

Cover and Layout Design

Judy Howard, Graphic Designer

University of Arkansas System Division of Agriculture Communications

Cover photo courtesy of Ben Butler

Back cover photo courtesy of Jerry Wohletz



This project is funded by a grant from the Walmart Foundation and administered by the University of Arkansas System Division of Agriculture Center for Agricultural and Rural Sustainability

The University of Arkansas System Division of Agriculture follows a nondiscriminatory policy in programs and employment.

Acknowledgements

The contributions and support of the following individuals are gratefully acknowledged:

University of Arkansas System

Dr. Donald R. Bobbit, President

University of Arkansas System Division of Agriculture

Dr. Mark Cochran, Vice President for Agriculture

Dr. Tony Windham, Associate Vice President for Agriculture – Extension

Dr. Clarence Watson, Associate Vice President for Agriculture – Research

Dr. Michael Vayda, Associate Vice President for Agriculture – Academic Programs and Dean of Dale Bumpers College of Agricultural, Food and Life Sciences, University of Arkansas, Fayetteville

Mark Scott, Chief Communications Officer

Mary Hightower, Director of Division of Agriculture Communications

Dave Edmark, Division of Agriculture Communications Coordinator

Jyllian Martini, Division of Agriculture Web Developer

Center for Agricultural and Rural Sustainability

Dr. Jun Zhu, Dr. Jennie Popp, Dr. Ron Rainey and Dr. Curt Rom, Co-Directors

Department of Agricultural Economics and Agribusiness

Dr. Steven Halbrook, Department Head

Department of Horticulture

Dr. Wayne Mackay, Department Head



Photo courtesy of Russ Schlagel

Contents

Introduction to the National Strawberry Sustainability Initiative	6
Summary of Accomplishments	7
Arkansas – Growing Strawberries: A Public-Private Partnership	8
• Grower Profile – Clyde Fenton, Fenton’s Berry Farm	10
Florida – Addressing Grower-Identified Priorities in Organic Strawberry Cropping Systems in the Southeastern U.S.	11
• Grower Profile – Don Long, 5K Farm	14
Maryland – Implementing Low-Cost Wireless Sensor Networks for Irrigation, Nutrient Management and Frost Protection of Strawberry	15
• Grower Profile – Ben Butler, Butler’s Orchard	17
• Grower Profile – Russ Schlagel, Schlagel Farms	18
North Carolina – Sustainable Soil Management Practices for Strawberries: Diverse Approaches for Facilitating Adoption	19
• Grower Profile – J.R. Odom, Odom Farming Co.	21
New Jersey – On-Farm Performance and Nutrient Requirements of New Strawberry Varieties for the Eastern United States	22
• Grower Profile – Jess Niederer, Chickadee Creek Farm	24
• Grower Profile – Dave Specca, Specca Farms	25
Texas – Increasing Grower Market Potential and Consumer Preference for Locally Grown Strawberries through Strategic Extension Programming in Texas.	26
• Grower Profile – James R. Moss, Moss Farm	28
• Grower Profile – Ronnie Wheeler, Wheeler Farms	29
• Grower Profile – Diann and Milton Woods, Millie’s Barn Veggie Farm	30
Other Growers	
• California – Ian Greene, Pacific Berry Farms	31
• Kansas – Jerry Wohletz, Wohletz Farm	32
• Virginia – Tom Baker, Brookdale Farm	33
Appendix	34

Introduction to Phase II of the National Strawberry Sustainability Initiative

Strawberries are an important fruit crop for American consumers and the U.S. economy. The sweet and nutritious strawberry is one of U.S. consumers' favorite fruits, with the average American consuming eight pounds of strawberries per year. The development of year-round production, driven by consumer demand, has allowed national production to double in the past 20 years, increasing the strawberry industry's worth to \$2.4 billion (2012) and making the U.S. a world leader in strawberry production. The demand for strawberries and the growth of the industry is projected to continue for many years.

Despite tremendous growth and technological developments, the highly productive strawberry production system is facing significant challenges to sustainability. The industry has become highly consolidated in the two production centers of California and Florida, while many other states that once supported thriving strawberry industries are losing acreage. Growers have lost the primary fumigant and source of disease and weed control, methyl bromide, due to bans from the Montreal Protocol and U.S. EPA. Fungicide inputs continue to be necessary to control pre-harvest diseases and fruit rots. The high perishability and short shelf-life of the fruit, coupled with long transportation distances have resulted in estimated product losses of up to 40 percent throughout the supply chain, with an estimated cost of \$1.14 billion. In recent years, labor shortages for hand-harvested strawberries have been reported, which can result in supply shortages and price increases at the consumer level. Lastly, prolonged drought in California has threatened the state's ability to continue to produce nearly 90 percent of the national crop.

In response to the challenges facing the U.S. strawberry system, the Center for Agricultural and Rural Sustainability (CARS) at the University of Arkansas System Division of Agriculture proposes that the sustainability of the industry can be improved by implementing new technologies

for current production and by increasing production at the local and regional levels to complement the primary production centers. The [National Strawberry Sustainability Initiative](#) (NSSI) was created with the intent of moving science-based technology from laboratories and experiment farms into producers' fields, distribution systems, and other industry operations. The goals of the NSSI are to decrease energy consumption, environmental impacts, and product loss in the supply chain, and to improve profitability for farmers. Sustainability and supply will be improved by increasing the number of farms producing strawberries to reduce travel distance and spoilage; by increasing strawberry yields; by developing new regionally-adapted cultivars; by extending the range of harvest dates with new technologies; by implementing new pest and soil management technologies; and by conserving water resources, thereby increasing the resiliency of our rural communities and supporting farm families across the U.S.



In harmony with the U.N. Brundtland Commission definition of sustainable development, the goal of the NSSI is to support U.S. strawberry growers and industries in achieving success today while positioning the next generation for success.

The NSSI administered a sub-grant process to foster and support programs across the country that implement the technology of sustainable production by partnering with growers, packers/shippers, distributors, and markets, thereby increasing the availability of strawberries to consumers. The NSSI was developed in two annual phases focused on production innovation, technology transfer, and outreach. NSSI Phase I implemented and demonstrated scalable technologies and production practices that improve strawberry system sustainability and provided significant outreach and training to growers and extension agents.

Accomplishments of the Phase I project are published in the e-book "[Moving the Needle](#)." The purpose of Phase II was to capitalize on successes in Phase I and scale up the sustainable technologies, moving from test and demonstration to direct implementation by project leaders working with key players throughout the strawberry supply chain. The goal was to enhance adoption of best management practices for production and distribution, as well as raise awareness of regional and locally available strawberries, thereby extending the impact of the NSSI.

Summary of Accomplishments

The National Strawberry Sustainability Initiative was funded with a generous grant from the [Walmart Foundation](#) to the [University of Arkansas System Division of Agriculture](#) Center for Agricultural and Rural Sustainability (CARS). The focus of the program was to move technology from demonstration to practice and to engage farmers directly with the goal of increasing the sustainability of the U.S. strawberry industry. Phase II of the NSSI began in February 2015, and in May, six proposals were selected from a nationally competitive Request for Proposal process. A total of \$845,500 in funds were distributed to projects in Florida, North Carolina, Maryland, New Jersey, Arkansas, and Texas.

The Phase II projects included testing of new strawberry cultivars; sustainable soil management; the expansion of organic strawberry production; community engagement through schools and gardens; season extension and pest exclusion using high tunnels and greenhouses; and implementing precision technology for water management and frost protection. The program involved farmers in all aspects, from project planning to assisting with demonstrations to hosting workshops and field days. Forty-eight individual farms participated in the six projects, playing a critical role in peer-to-peer information exchange.

Outreach and engagement was an important outcome of the NSSI. More than 80 local, regional, national and international presentations were given by Phase II project leaders, with results shared at more than 50 grower training sessions and more than 20 grower associations and scientific conferences. Some 2,050 farmers and 394 extension agents were reached. More than 30 undergraduate and graduate students participated in the research, demonstration and outreach of the NSSI projects and are positioned as the next leaders for sustainability in production, research, education, and outreach.

Engaging diverse audiences through multiple platforms has been important to the success of the NSSI. The NSSI website has had more than 10,700 visits. The "[Moving the Needle](#)" e-book has been widely distributed and promoted or reviewed on approximately a dozen other websites. Phase II projects generated 63 stories in local, regional and national media. The NSSI [Facebook page](#) and project pages have frequent visits and many subscribers. The [YouTube channel](#), with more than 80 project videos, has had more than 10,000 views, and nearly 23,000 minutes of viewing. In total, Phase II projects have reached more than

4 million people through news stories, radio talk shows, Facebook pages, websites, YouTube sites, presentations, conferences, workshops and field days. Details of the projects, impacts and outcomes follow in this report.

The NSSI leadership team and CARS are deeply grateful for the support of the Walmart Foundation in funding the program. The public-private partnership between the Walmart Foundation, the University of Arkansas, and all the collaborating universities and growers is a model that has demonstrated success and impact. As a result of the NSSI, several states have developed "strawberry fever," with increased production and grower interest and there is a new optimism for producing strawberries in the U.S. As with any program of this nature, the impact will be felt well into the future. There is a proverb that says, "*A pebble cast into a pond makes ripples radiating outward and landing on distant shores.*" Such is the impact of the NSSI. As growers have observed, learned, tested, adapted and implemented production information and technology provided by the NSSI and its 26 projects, a change has begun to ripple throughout the strawberry industry. The impact of the NSSI has been strong and immediate. The outcomes of this program will be felt for years to come.



Strawberries being sold at the farmers market in San Luis Obispo, California. Photo by Curt Rom.



Graduate student Megan McGovern discusses high tunnel strawberry production at the High Tunnel Fruit Workshop at the Arkansas Agricultural Research and Extension Center in Fayetteville. Photo courtesy of Elena Garcia.

ARKANSAS

Growing Strawberries: A Public-Private Partnership

Leadership Team

- Elena Garcia, University of Arkansas System Division of Agriculture, Cooperative Extension Service
- Michael Evans, University of Arkansas System Division of Agriculture, Department of Horticulture
- Donn Johnson, University of Arkansas System Division of Agriculture, Department of Entomology

Project Collaborators

- Jackie Elliott, North Arkansas College
- Kristen Gibson, University of Arkansas, Department of Food Sciences
- Clyde Fenton, Fenton's Berry Farm, Harrison, Arkansas
- Mike McClintock, University of Arkansas System Division of Agriculture, Cooperative Extension Service-Boone County

Project Summary

This project addressed the growing interest in revitalizing the fruit industry in Arkansas, especially strawberry production in Washington and Boone Counties. The

project used a unique public-private partnership between the University of Arkansas System Division of Agriculture in Fayetteville, North Arkansas College in Harrison, and strawberry growers in Washington and Boone Counties. Through this partnership the project pursued functioning business enterprises producing and marketing strawberries and utilized a cooperative approach to transfer proven protected culture technologies to growers that were learned during Phase I NSSI projects.

Objectives of the project were to validate protected agriculture technologies for sustainable strawberry production in high tunnels, low tunnels, and hydroponic greenhouse systems; to demonstrate the integration of pest management using insect predators, exclusion netting, and other sustainable practices; to assess the food safety risk of strawberry production; and to validate the economic sustainability of the individual production systems.

Project Outputs and Impacts

This project hosted six strawberry production workshops throughout the state on a variety of topics including sustainable cultural practices, protected environments,

insect management, disease management, and economic considerations, reaching more than 130 participants, including extension agents and growers. Demonstration production systems including high tunnels, low tunnels, and soilless greenhouse culture were designed and constructed to engage extension agents, growers, and students in advanced strawberry production technology. A new low tunnel design was developed to pair strength with functionality and shared with other institutions to facilitate farmer adoption. Evaluations revealed that at least half of workshop participants planned to construct greenhouses and/or tunnels for strawberry production using the knowledge they gained and that several individuals were going to begin producing strawberries for the first time. An Interactive Sustainable Strawberry Budget tool was developed to help growers calculate costs and expected net returns for field or high tunnel strawberry



Arkansas project leaders conduct a tour of the greenhouse facilities at North Arkansas Community College where soilless strawberry production is being demonstrated. Photo courtesy of Elena Garcia.



production systems. This tool helps growers make sustainable management and production choices by accurately assessing risk and creating “what if” scenarios. Overall, this project equipped farmers with the technology and information needed to grow strawberries smarter and enabled extension agents and educators to continue to inform future growers about sustainable strawberry production in Arkansas and the surrounding area.

Publications

- [Interactive Sustainable Strawberry Budget](#) and [user-guide](#)

Websites

- [YouTube channel](#)
- [Project photos](#)

Donn Johnson releases C-Mac ladybeetles (*C. maculata*) to biologically control aphids in the strawberry high tunnel at North Arkansas Community College. Photo courtesy of Elena Garcia.

Grower Profile

Clyde Fenton – Fenton’s Berry Farm

Harrison, Arkansas

“Growing Strawberries: A Public-Private Partnership”

Project Leader Elena Garcia, University of Arkansas System Division of Agriculture, Cooperative Extension Service

Fenton’s Berry Farm is a small fruit and vegetable farm in Northwest Arkansas, with five to seven acres in production, including a high tunnel for strawberries, an acre of blackberries and an acre of blueberries.

When Clyde Fenton and his wife, Veronica, started farming in Arkansas 13 years ago, after 10 years of farming in upstate New York, they started out raising strawberries the way he knew, as matted row production for pick-your-own. “We got up to 2.5 acres at one point,” Clyde said, “but I got discouraged. Here in the Ozarks, we’d get to the peak of our season, and every year we’d get 4 to 5 inches of rain.” Four years ago, he purchased a 26- by 96-foot tunnel with the help of the NCRS cost-share program and started raising some of his strawberries on an annual bed system in the tunnel. “Three years ago was the last time I had berries outside,” Clyde recalled. “They were looking really beautiful, and then it did what it always does — rain.”

Fenton has six beds of strawberries in the tunnel, which can fit about 1,000 plants. It’s not a huge amount of production, but he likes the quality of tunnel berries. He mostly grows ‘Chandler,’ but has also experimented with the Florida cultivar Festival and day-neutrals Sweet Ann and San Andreas. While most of the farm’s other crops are sold at farmers markets or at the Fentons’ new retail farm store, their strawberries are sold strictly on a pre-order basis, with customers coming to the farm to pick them up.

In 2013-2014, Clyde served as a consultant helping North Arkansas College (NAC) start to raise strawberries in a 30- by 96-foot high tunnel. During the 2014-2015 season, the college became involved in the University of Arkansas NSSI project, exploring three different growing environments for strawberry production: high tunnel, low tunnel, and greenhouse.



Clyde Fenton with his dog Bosco. Clyde and his wife started Fenton’s Berry Farm in 2002. Photo courtesy of Clyde Fenton.

“We had two workshops in the spring,” Clyde said, “each with about 30 to 40 people; the first on protected agriculture and the second more specifically on raising strawberries in tunnels [and greenhouses].” The project also hosted many tours throughout the year for master gardener groups and schools. In addition, Clyde taught an Introduction to Horticulture course as an adjunct instructor at NAC in spring 2015.

“The low tunnels brought the plants through the winter very nicely,” Clyde said, “but we had to anchor down the plastic because of winds, and it was difficult to ventilate them well. It was a wet spring and we had major fungal problems. I didn’t find [the low tunnels] user-friendly.” He liked the modified low tunnels better, which were high enough to walk through and had better ventilation and better quality fruit, although if he were to use them again, he’d want to have sturdier construction. He loved working with the hydroponic greenhouse strawberries. “It was new to me and fun to learn. But I see hydroponic strawberries as a very specialized crop, requiring constant attention and lots of technical skills, not for the diversified small farmer.”



Arkansas project leaders Dr. Elena Garcia and Dr. Mike Evans visit with Fenton in his strawberry high tunnel. Photo courtesy of Clyde Fenton.

Several workshop attendees are planning to build tunnels, Clyde said — and he’s sold on tunnel production for his own farm. “I’m probably not the typical farmer. When I look at the quality of strawberries I can produce, I want to do it, but I can’t produce enough to meet the demand. It takes a different frame of mind than for a 10-acre strawberry grower, but tunnels work well for the small diverse farmer. Even without the NRCS grant, I felt I

could pay for the tunnel in two years and then be profitable.” He’d like to put in more high tunnels and use them for other crops, as well. Said Clyde, “That’s the direction I need to go, more weatherproof.”

He’d also like to see the college continue to encourage specialty crop production, such as strawberries, in this area where farmers primarily raise poultry, hay, and cattle. As he finishes up a masters degree in agricultural education, and after this year of teaching and talking about strawberries, he’d like to continue to teach and to encourage others to get started in horticulture and in strawberries.



Oscar Liburd and Elena Rhodes of University of Florida discuss pest identification at the Organic Strawberry Field Practicum on March 3, 2015. Photo by Yu Zhang.

FLORIDA

Addressing Grower-Identified Priorities in Organic Strawberry Cropping Systems in the Southeastern U.S.

Leadership Team

- Carlene Chase, University of Florida, Horticultural Sciences Department
- Xin Zhao, University of Florida, Horticultural Sciences Department
- Oscar E. Liburd, University of Florida, Department of Entomology and Nematology
- Zhifeng Gao, University of Florida, Food and Resource Economics Department
- Sanjun Gu, North Carolina A&T State University Cooperative Extension Program, Horticulture
- Marilyn (Mickie) E. Swisher, University of Florida, Center for Sustainable and Organic Food Systems

Project Collaborators

- Marty Mesh, Florida Certified Organic Growers and Consumers, Inc.
- Alejandro Bolques, Florida A&M University, FAMU Research & Education Center
- Sambhav, Driscoll Strawberry Associates, Tampa, Florida

Project Summary

The goal of this grower-directed, multidisciplinary research and extension project was to promote the expansion of organic strawberry production in the Southeastern U.S. by designing organic strawberry cropping systems that are more environmentally and economically sustainable and are resilient to weeds, pests, and diseases. Project partners include North Carolina A&T State University, Driscoll Strawberry Associates Inc., Florida Certified Organic Growers and Consumers, Inc. and four organic growers in Florida and North Carolina. Project activities included the evaluation of various components of an organic strawberry system, including cultivar trials, cover crop evaluations for weed and nematode management, high tunnel production, and insect and mite pest management practices, on organic farms and experiment station land in Florida and North Carolina. Additionally, a nationwide survey to determine customer preferences was conducted. Outreach activities included research assessments, three field days, one workshop, and oral and poster presentations at grower and scientific conferences.

Project Outputs and Impacts

Florida cover crop studies resulted in sunn hemp (*Crotalaria juncea*) producing the greatest dry biomass, which exceeded 6,245 pounds per acre. Growers using this cover crop for organic strawberry production may need to consider nutrient credits when managing soil fertility. Various *Crotalaria* species were tested for susceptibility to sting nematode, a key pest in strawberry production in Florida. The sunn hemp cultivar Tropic Sun was not susceptible, which is an important consideration if using sunn hemp as a cover crop before strawberry planting. One farmer-cooperator decided that he will use more sunn hemp as a cover crop because it effectively suppressed volunteers from a previous edible leaf amaranth crop. Results from trials with selected strawberry cultivars in Florida indicated that full-season marketable and total fruit weights did not differ among cultivars; however, 'Festival' had the highest marketable fruit number, the lowest average fruit weight, and the highest level of total monomeric anthocyanins. Additionally, higher nutrient use efficiency



Growers assess the performance of strawberry cultivars in on-farm research at Frog Song Organics in Hawthorne. Photo by Damion Graves.



Cover crop plots of short-flower rattlebox, American jointvetch, hairy indigo, and sunn hemp grow at the Citra research station to study their benefit in organic strawberry production. Photo by Carlene Chase.

and soluble solids were observed in 'Festival.' In North Carolina, organic high tunnel cultivar trials were conducted. At Greensboro, 'Radiance' had the highest yield, though not statistically higher than 'Benecia,' 'Chandler,' 'San Andreas,' and 'Winterstar'™; whereas at Goldsboro, yields of the 10 cultivars evaluated were not statistically different. At least seven North Carolina growers will grow organically managed strawberries using high tunnels this fall. Fifty-eight strawberry growers were trained on how to identify spotted wing drosophila (*Drosophila suzukii*) and how to recognize infested fruit. Results of 825 survey responses indicate that customers who identify as local, farmers market, organic, or CSA consumers care less about color, freshness, dryness, price, firmness and flavor, but care more about other attributes such as container size, shape, aroma, product origin, production methods and cultivar. Participants in grower assessments provided recommendations and suggestions for future organic strawberry research and prioritized future research objectives such as expanding research on integrated and long-term research on cover crops, strawberry cultivars, disease and pest management, and consumer preferences research. Five of the grower-participants committed to serving as advisors for future projects. This NSSI project has provided sufficient information to warrant further efforts towards holistic research of organic strawberry breeding and selection, nutrient and water management, and disease and pest control for long-term environmental and economic sustainability. As a result of this project,



Several different strawberry cultivars were assessed for organic production in on-farm research at Frog Song Organics in Hawthorne. Photo by Yu Zhang.

project leaders were awarded a grant from the USDA Organic Research and Extension Initiative to continue this work to improve sustainable organic strawberry production in the Southeast.

Publications

- Two North Carolina Extension publications: “Organic Strawberry 101” and “Organic Strawberry Production in High Tunnels.” Soon to be located here: <http://smallfarms.ag.ncat.edu/>.

Project Photos

Project Video

- [“Addressing Grower-Identified Priorities in Organic Strawberry Cropping Systems in the Southeastern United States”](#)

Presentations

- [Distribution and Management of Spotted Wing Drosophila in Florida Berry Crops](#)
- He, C., Z. Gao, C. Sims and X. Zhao. [Does Local Label Bias Consumer Taste Bud and Choice Behavior:](#)

[Evidence of a Strawberry Sensory Experiment](#). Southern Agricultural Economics Association (SAEA) Annual Meeting, Jan. 31-Feb. 3, 2015, Atlanta, GA.

- Chase, C.A., G.B. Braz and M.E. Swisher. 2015. [Promoting Adoption of Cover Crops for Weed Suppression by Broadening their Utility](#). Weed Science Society of America Annual Meeting, Feb. 9-12, 2015, Lexington, KY.
- Chase, C.A., G. Braz and T. Garrick. 2015. [Off-season Weed and Sting Nematode Management for Organic Strawberry](#). American Society of Horticultural Sciences Annual Conference, Aug. 4-7, 2015, New Orleans, LA.
- Xie, Y., X. Zhao and Z. Black. [The Influence of Fertilizers from Different Nitrogen Sources on Strawberry \(*Fragaria xananassa*\) Production](#), American Society of Horticultural Sciences Annual Conference, Aug 4-7, 2015, New Orleans, LA.
- Gu, S., J.E. Beck, J.A. Moore and W. Guan. 2015. [Cultivar Evaluations for Organic Strawberry Production in High Tunnels](#), American Society of Horticultural Sciences Annual Conference, Aug. 4-7, 2015, New Orleans, LA.
- Chen, X., Z. Gao, M. Swisher, L.A. House. 2015. [Willingness to Pay for Eco-labeled Fresh Strawberry: Are All Environmentally Friendly Techniques Equal?](#) Agricultural and Applied Economics Association, July 26-28, San Francisco, CA.

Grower Profile

Don Long — 5K Farm

Plant City, Florida

“Addressing Grower-Identified Priorities in Organic Strawberry Cropping Systems in the Southeastern U.S.”

Project Leader Carlene Chase, University of Florida

The Plant City area of Florida produces about 10 percent of the nation’s strawberries, but organic production is a challenge because of high disease and nematode pressure. When Don Long decided to start raising organic strawberries on contract to Driscoll’s®, it was an exploratory project for both Don and the company. Don had 35 years of experience raising produce — mostly tomatoes, but also organic strawberries and table grapes. He had been using crab meal to control nematodes organically and also operated a business marketing crab meal as a soil amendment. The six-acre field that was going to be used for the organic planting was an old citrus grove that had been fallow for eight years and planted in bahiagrass, so no transition period was required for organic certification.

Don partnered with University of Florida researchers to investigate cover crops for organic weed and nematode suppression and study the performance of eight different cultivars in organic production. Researchers planted the cover crops in June and July, and used GPS to set out the small plot replications within them. The cover crops were cut and worked into the soil in September, before the beds were made. The rest of the field was prepared using



Don Long collaborated with the University of Florida to research organic strawberry production on his own farm in Plant City. Photo courtesy of Carlene Chase.

soil solarization and applications of crab meal as organic alternatives to fumigation. In total an acre of the field was used for the research plots, with six cover crop treatments and eight cultivars (Treasure, Radiance, Festival, Camarosa, Winterstar™, Albion and two Driscoll’s® varieties) in four replications. The researchers provided a graduate student and another helper to harvest. The two would make the two-hour drive from Gainesville and spend all day harvest-ing, weighing, grading, and recording the harvest.

“I think we did a good job growing them,” Don said, “and we did our same organic pesticide program on the research plots. Our predator mite program worked really well.” One mistake, he thinks, was including the cultivar Treasure, which is known to be especially susceptible to anthracnose. It’s a serious disease in strawberries and especially hard to control organically. It was a particularly rainy season, and disease in this susceptible variety quickly spread to other plots.

“I plan to continue to raise organic strawberries,” Don said. “There is a great need for practical, applied research. If you are running a variety trial, don’t complicate it with other variables. Keep it simple, and be aware of what has already been researched and whether it worked or not. I’d like to see some good tests of the various organic products now available for fertigation and soil amendments. It’s hard to get good organic information.”



5K Farm grows organic strawberries in Plant City, Florida. Photo by Javier Lopez.

The strawberry research plots at the University of Maryland's Wye Research and Education Center in Queenstown allow the research team to investigate the effect of drought stress on strawberry yield and fruit quality. Photo by Bruk Belayneh.



MARYLAND

Implementing Low-Cost Wireless Sensor Networks for Irrigation, Nutrient Management and Frost Protection of Strawberry

Leadership Team

- John Lea-Cox, University of Maryland, Department of Plant Science and Landscape Architecture
- Erik Lichtenberg, University of Maryland, Department of Agricultural and Resource Economics
- John Majsztrik, University of Maryland, Department of Plant Science and Landscape Architecture
- Bruk Belayneh, University of Maryland, Department of Plant Science and Landscape Architecture

Project Collaborators

- Robert Rouse, Agriculturalist, LLC, Denton, Maryland
- Russ Shlagel, Shlagel Farms, Waldorf, Maryland
- Ben Butler, Butler's Orchard, Germantown, Maryland

Project Summary

Irrigation water scarcity is a serious problem affecting the major strawberry production regions of the U.S. In addition, restrictions limit the amount of chemicals (fertilizers, fungicides, and pesticides) that can leach from or run off strawberry farms in the mid-Atlantic. The main objective of this project was to install wireless sensor networks

(WSNs) to implement ultra-precision irrigation and nutrient management on commercial strawberry farms and so address sustainability goals for conserving and preserving water resources and reducing chemical inputs for fertilization. The WSNs were deployed on two commercial strawberry farms representing two production systems: matted row (Butler's Orchard in Germantown, Maryland) and plasticulture (Shlagel Farm in Waldorf, Maryland). The project documented costs and benefits associated with the WSNs at the two commercial farms and compared them to current grower practices. Changes in input costs, labor savings, and productivity were used to calculate return on investment of the WSN technology to determine the potential for economically sustainable strawberry production.

The objectives of this project were to quantify and demonstrate the effects of sensor networks on water use, crop growth, and fruit quality on commercial strawberry farms; to study the effects of decreased irrigation regimes; to investigate the potential of sensor networks to provide site-specific frost alerts to farmers; and to quantify the economic impact of using sensor networks for irrigation, nutrient management, and frost protection.



John Lea-Cox discusses wireless sensor networks for strawberry production during the Annual Strawberry Twilight Meeting at the Wye Research and Education Center on May 26, 2015. Photo by Bruk Belayneh.

Project Outputs and Impacts

The project found that sensor networks were able to improve the profitability of strawberry operations by reducing management time and optimizing irrigation input to production output. An in-depth economic analysis of the return-on-investment showed that sensor-controlled irrigation can be successfully implemented for strawberry production with reasonable returns on investment, even when above-average rainfall is received. Data analysis also revealed how minor adjustments in irrigation can greatly impact crop quality, emphasizing the importance of adequate irrigation during flowering and fruit set. The integration of frost sensors allowed for canopy temperature management as well, informing growers when to place and remove row covers during the winter and spring and sending text alerts to growers to warn of frost events. These frost sensors also reduced the cost of operation by eliminating the need for farmers to manually monitor temperatures and allowing the growers to make precise decisions based on real-time information to avoid unnecessary applications of water for frost protection.

Information was shared with stakeholders through a strawberry field day for local farmers, a summer tour organized for the North American Strawberry Growers Association (NASGA), and visits to national program managers and congressional members and their staffs. Results from

the project were presented at national and international conferences to growers, industry personnel, students and researchers across the United States (ASHS Annual Conference, New Orleans) and from around the world (ISHS VIII Irrigation Symposium, Lleida, Spain).

Publications

- Belayneh, B.E., and J.D. Lea-Cox. 2015. Using Sensor Networks to Maximize Irrigation Water Use Efficiency in Strawberry Production. VIII International Symposium on Irrigation of Horticulture Crops, Lleida, Spain. June 8-11, 2015. In *Acta Horticulture* (In review).
- Belayneh, B. and J.D. Lea-Cox. 2015. [Using Wireless Sensor Networks for Irrigation and Nutrient Management in Strawberry Production](#). HortScience 49(S): (In press).

Websites

- [Project Website](#)
- [Project Photos](#)

Videos

- ["Strawberry Fields Forever"](#)



Wireless sensors at Shlagel Farms in Waldorf, Maryland monitor soil moisture and air temperature allowing for real-time monitoring. Photo by Bruk Belayneh.

Grower Profile

Ben Butler – Butler’s Orchard Germantown, Maryland

“Implementing Low-Cost Wireless Sensor Networks for Irrigation, Nutrient Management and Frost Protection of Strawberry”

Project Leader John Lea-Cox, University of Maryland

When George and Shirley Butler started Butler’s Orchard in the early 1950s as a pick-your-own farm, few people were aware of the concept. Their children and grandchildren now run the much-expanded farm, including Ben Butler, assistant farm manager and third-generation Butler farmer. Located within suburban and highly developed Montgomery County, where few farms remain, the Butlers provide a special on-farm experience for their huge customer base, including many school groups for blossom tours in the spring and pumpkin tours in the fall.

Their progression of pick-your-own crops starts with strawberries and peas in the spring, continues through tart cherries, blueberries, black raspberries, blackberries, potatoes, tomatoes, herbs, flowers, fall red raspberries, pumpkins, and apples, and ends with Christmas trees. They also have a retail farm market and bakery, with about five acres devoted to producing vegetables for the retail market.

Strawberries have been grown on the farm since 1953 and the Butlers currently have 18 acres in matted row production. Said Ben Butler, “We explored plasticulture about 15 years ago, but it just didn’t fit into the way we do things. It requires more intensive management, especially for row covers and frost protection, with the plants blooming several weeks earlier, and is more difficult to fit into our rotations.” The Butlers typically keep a strawberry planting for four to six years and do not fumigate.

Ben says he helped plant the seed of the idea for the Maryland Strawberry Sustainability Initiative project exploring the use of wireless sensor technology in strawberries. “I took a class on greenhouse technology with Dr. Lea-Cox when I was in college at the University of Maryland, and started to wonder, ‘How can I use this in our operation?’ I felt that frost protection was a major challenge, and I knew my father would be out checking thermometers in the field one at a time — and then I’d get a



Third-generation farmer, Ben Butler, collaborated with Professor Lea-Cox to implement wireless sensor technology at Butler’s Orchard in Germantown, Maryland. Photo courtesy of Ben Butler.

call in the middle of the night to help start the irrigation. I asked Dr. Lea-Cox if there was anything growers could do to better manage this, and I think he kept it in his head, and later came to me with the idea for a proposal.”

The project set up an array of air temperature and soil-moisture sensor nodes in a 1.5-acre field, and also set up sensors in a low-lying area likely to frost before the rest of the farm. Besides monitoring temperatures, the sensors collect data relating to soil moisture and fertilizer levels, with the goal of making it possible for growers to provide optimum growing conditions to the crop and reduce excessive water and fertilizer application. The project also provided a weather station that collects even more data, including air temperature, relative humidity, solar radiation, wind speed and rainfall. Ben can access all of this information both from a base computer and through the internet on his smartphone.

The frost alert function wasn’t needed this spring because of a lack of frost events, but Ben has already found many other ways to use the system. “It generates a ton of data. One of the nicest parts is that it can measure bloom and air temperatures, which is really helpful for evaporative cooling during harvest. I’m actively using the program and will still use it for other crops when strawberries are finished. I’d love to use it in blueberries to monitor soil moisture. The weather station is almost invaluable at this point — right now I’m watching wind speed and direction as I get ready to spray the sweet cherries.” He’s also excited about another potential project that would incorporate sensors for leaf wetness into a forecasting program for gray mold (*Botrytis*) and anthracnose in strawberries, indicating when conditions are conducive to outbreaks.

“We really believe in the project and the methods,” Ben said. “Sustainability has become such a polarized buzzword. I think a lot of farmers back away because of misconceptions.”



The Butlers have been growing matted row strawberries as a pick-your-own crop since 1953. Photo courtesy of Ben Butler.

Grower Profile

Russ Schlagel – Schlagel Farms Waldorf, Maryland

“Implementing Low-Cost Wireless Sensor Networks for Irrigation, Nutrient Management and Frost Protection of Strawberry”

Project Leader John Lea-Cox, University of Maryland

Shlagel Farms, in Waldorf, Maryland, 20 miles south of Washington, D.C., raises 4.5 acres of strawberries and was one of the earliest adopters of plasticulture in the state. “I tried matted row,” said owner Russ Shlagel, “but it was a dismal failure. Then I visited Plant City, Florida, in 1995, and thought ‘I can do this.’”

In 1999 Shlagel planted his first strawberry crop, having waited a few years for the local Wye Research Station to first test out plastic much for strawberries. He found the annual plasticulture system a much better fit, partly because he was already using plasticulture on the farm for vegetables. Shlagel Farms raises more than 100 acres of other produce, including asparagus, cabbage, squash, melons, tomatoes, peppers, sweet corn and pumpkins. They also lease another farm which grows peaches and blackberries. They sell their produce at 10 farmers markets in Washington, Baltimore and Arlington, and also sell wholesale. “I was fortunate to connect with the Giant Foods supermarket chain in the 1990s when they were first getting serious about buying local,” Russ commented. Another major buyer is a large food service distributor. Strawberries in the spring and pumpkins in the fall are the only crops sold as pick-your-own; the rest of the season, their only on-farm retail sales are through a Saturday morning CSA.

The farm’s strawberries are mostly ‘Chandler,’ with some ‘Sweet Charlie’ to start the season, and a few rows of something else being trialed in the perennial search for a good replacement for ‘Chandler’ (he hasn’t found it yet). They



Russ Schlagel sells strawberries at farmers markets in Baltimore, Arlington, and Washington, D.C. Photo courtesy of Russ Schlagel.

put row covers on in the fall, between Thanksgiving and mid-December, and leave them on until late February or early March. “If we didn’t use covers, we wouldn’t be able to get the

early crop,” Russ observed. Covers are used on-and-off for frost protection, and then harvest generally starts late April to early May.

Strawberry fields at Shlagel Farms are divided into half-acre blocks of 10 rows, each row 325 feet long. Russ worked with the Maryland “Sensing Berries” Strawberry Sustainability Initiative Project to use most of one block to deploy sensors able to monitor factors such as ground temperature and soil moisture levels on eight rows, all connected wirelessly to a computer. On four rows, Russ followed his normal practices. On the other four rows, the system controlled both timing and amount of irrigation, with the idea that precision management of water could both reduce water use and increase yields. Russ also advocated for sensors to be placed under the row covers, so they could get data on the effectiveness of the covers for frost protection. There was almost no need for frost protection this spring, but the sensors confirmed that the covers raised plant zone temperatures considerably throughout the winter. At harvest time, researchers harvested and collected data on a sample 40 plants in each row.

Russ says he is glad he participated, and is considering partnering with the project for a second year. He sees a “great opportunity to educate more than 10,000 people about research in agriculture and resource management” by setting up an information display about the project in the sales shed. He’s now looking forward to seeing what the data shows. “It’s a worthwhile project and they are going to come up with a lot of good data. In the long run, I think this kind of system is going to save us money as producers, save water, and increase yields. It may not be for everyone, but I think there’s going to be a place for it.”

Sensors were installed at Schlagel Farms in Waldorf, Md., to monitor soil moisture and independently control irrigation based on plant water needs. Photo by Bruk Belayneh.



CEFS small farm manager Marisa Benzle and Horticulture Specialist Dr. Sanjun Gu from NC A&T discuss high tunnel organic strawberry production. Photo by Amanda McWhirt.

NORTH CAROLINA

Sustainable Soil Management Practices for Strawberries: Diverse Approaches for Facilitating Adoption

Leadership Team

- Michelle Schroeder-Moreno, North Carolina State University, Department of Crop Science
- Amanda McWhirt, North Carolina State University, Department of Crop Science

Project Collaborators

- Gina Fernandez, North Carolina State University, Department of Horticulture Science Extension Specialist
- Yasmin Cardoza, North Carolina State University, Department of Entomology
- Hannah Burrack, North Carolina State University, Department of Entomology and Extension Specialist
- Olya Sydorovych, North Carolina State University, Department of Agricultural and Resource Economics
- Kevin Schooley, North American Strawberry Growers Association
- Lisa Vines, North Carolina Strawberry Association, Executive Secretary

Grower Collaborators

- J.R. Odom, [Odom Farming Co.](#)
- Russ Vollmer, [The Vollmer Farm](#)
- Billy Carter, Carter Farm
- Lee Berry, [The Berry Patch](#)
- Sonny Cottle, [Cottle Strawberry Nursery and Farms](#)
- Karma Lee, [Buckwheat Farm](#)

Project Summary

Maintaining soil health and productivity in an annual strawberry plasticulture system is a challenge, especially in the Southeastern U.S. where weathered soils with low organic matter are common. The overall goal of the North Carolina project was to increase adoption of sustainable soil management practices, including composts, cover crops, and beneficial soil inoculants (vermicomposts and arbuscular mycorrhizal fungi) in commercial strawberry

Ph.D. student Amanda McWhirt discusses soil management practices for sustainable strawberry production at the Center for Environmental Farming Systems (CEFS) in Goldsboro, N.C. Photo by Amanda McWhirt.

farms. The project team partnered with four strawberry growers, one strawberry plug producer and one research station to demonstrate these practices and improve technology transfer to growers. Results were shared through Extension workshops, conference talks, field days, project videos, and through the North Carolina Strawberry Association. An Extension publication, an on-farm research report, and an interactive strawberry budget comparing these practices were developed, and a peer reviewed scientific journal article was accepted for publication. Grower experiences were highlighted in a video series called Views from the Field (see links below).

Project Outputs and Impacts

As a result of project activities that included workshops, field days, conference presentations, videos, on-farm research, and outreach publications and articles, more than 500 growers and 100 Extension educators in the Southeastern U.S. have increased their awareness and knowledge of practices that sustain soil health. Workshop evaluations indicate that more than 50 percent of participants said they would change their practices to include sustainable soil management practices. All of the on-farm collaborators now have first-hand experience with the management associated with cover crops, compost and plug inoculations. One of the on-farm collaborators, who is a conventional strawberry grower and farmer-leader in his community, has become an advocate of soil health practices and has signage in his strawberry fields about the project. His farm receives more than 3,000 visitors per year through CSA, pick-your-own and agritourism activities; these visitors now know about the sustainable practices he is implementing.

Research experiment results indicated that the soil management practices did not consistently impact yields in the two years of the experiment. However, when averaged over the two years, plug inoculation yielded the highest in fumigation systems and cover crops alone yielded the highest in the fumigated system. Additional research results can be found in the [On-farm Evaluation of Sustainable Soil Management Practices](#) report.



Publications

- [Strawberry Production Budgets](#)
- [On-farm Evaluation of Sustainable Soil Management Practices for North Carolina Strawberry Production](#)
- [Sustainable Practices for Plasticulture Strawberry Production in the Southeast](#)
- Rysin, O., A. McWhirt, G. Fernandez, F.J. Louws and M. Schroeder-Moreno. 2015. [Economic Viability and Environmental Impact Assessment of Three Different Strawberry Production Systems in the Southeastern United States](#). Hort Technology 25:585-594.

Project Websites

- [Facebook Page](#)
- [Project Photos](#)

Videos

- [“Views from the Field: Russ Vollmer Interview”](#)
- [“Views from the Field: JR Odom Interview”](#)
- [“Views from the Field: Karma Lee Interview”](#)
- [“2015 SE Strawberry Enterprise Budgets Tutorial”](#)



Strawberries ripen at the field research site at the Center for Environmental Farming Systems (CEFS) in Goldsboro, NC. Photo by Michelle Schroeder-Moreno.

Grower Profile

J.R. Odom – Odom Farming Co.

Goldsboro, North Carolina

“Sustainable Soil Management Practices for Strawberries: Diverse Approaches for Facilitating Adoption”

Project Leader Michelle Schroeder-Moreno and Amanda McWhirt, University of North Carolina State University

J.R. Odom and his wife, Emily, farm in Goldsboro, N.C., with a focus on selling directly to the public. On the farm’s 46 acres, he currently has 2.5 acres of strawberries, 5 acres of vegetables, 10.5 acres of pumpkins, and a 20-acre corn maze. The Odoms offer pick-your-own for spring strawberries and fall pumpkins, along with educational field trips during both seasons, and sell their summer vegetables through a 20-week CSA that has 75 members. They also buy vegetables from other nearby growers to supplement their own produce in the CSA boxes. “We have a lot of neighbors raising vegetables,” J.R. observed, “but hardly anyone is raising fruit. I love raising strawberries, and we are planning to add blueberries and blackberries. We’d rather specialize and not compete with [our neighbors].”

This third-generation farmer is committed to rebuilding the soil on his farm. “It’s old tobacco land, but my grandfather always rotated crops,” J.R. said. “When I started farming, the first few years I grew all cotton and then all soybeans, and ran down [soil quality]. So I was searching for something like this project. I felt we needed to do something to increase the fertility of our soil.”



Strawberries ripen at Odom Farming Co. J.R. Odom partnered with NCSU to incorporate sustainable soil management practices into his strawberry operation. Photo courtesy of J.R. Odom.



J.R. Odom holds up a strawberry plug grown on his farm and inoculated with beneficial fungi and vermicompost. Photo by Amanda McWhirt.

J.R. decided to include his entire strawberry planting in the project, which explored sustainable soil management practices for strawberries. He trialed all of the practices included in the project — compost, cover crops, mycorrhizal fungi and vermicompost. Although he had intended to fumigate, the weather wasn’t cooperative, so for the first time, none of his strawberry land was fumigated. Researcher Amanda McWhirt came out to the farm to inoculate the plugs J.R. had raised. “It was all very easy,” J.R. said. “They covered the cost of the cover crops and compost, and we never felt pressure to change what we do beyond what we were comfortable with.”

“I had some problems with calibrating the seeder for the cover crop, so we got a very good stand in part of the field and had to buy more seed. And we didn’t have a flail mower, but we bush-hogged the cover crop twice, and had no problem getting it broken down before we incorporated it. Amanda did some testing, and we figured we got 60 units of nitrogen from the cover crops — that was our preplant fertilizer on those sections.” Fertilizer was applied on plots according to soil test recommendations, and standard fertigation and management practices were followed throughout the growing season.

Has he seen differences? There was very little visual difference with the inoculated plugs, J.R. said, but they seemed to root better, establish more quickly after they were transplanted, and start growing more rapidly coming out of dormancy in the spring. He also thinks that the untreated control plot had more disease pressure and smaller berries. He also expects to see a difference in drainage and tilling when the plastic is removed to prepare the land for the next crop.

But he’s thinking long-term, and whether or not the research continues, he plans to continue the project on his own. “I don’t think we’ll see improvements in the yield side in the first five years,” J.R. said. “And I think if we take care of the soil and make it better that will take away a lot of the problems we have.”



New Jersey strawberry grower Jim Giamarese discusses Rutgers strawberry varieties with filmmakers. Photo by Richard Weidman.

NEW JERSEY

On-Farm Performance and Nutrient Requirements of New Strawberry Varieties for the Eastern United States

Leadership Team

- Peter Nitzsche, Rutgers University, New Jersey Agricultural Experiment Station
- William Hlubik, Rutgers University, New Jersey Agricultural Experiment Station
- Mathew Millburn, Rutgers University, New Jersey Agricultural Experiment Station

Project Collaborators

- Daniel Ward, Rutgers University, New Jersey Agricultural Experiment Station
- Beverly Tepper, Rutgers University, New Jersey Agricultural Experiment Station
- Timothy Nourse, Nourse Farms Inc., South Deerfield, Massachusetts
- Robert Swanekamp, Kube-Pak Corp., Allentown, New Jersey
- David Handley, University of Maine
- Kathleen Demchak, Pennsylvania State University
- Michael Newell, University of Maryland
- Vance Whitaker, University of Florida

Project Summary

Rutgers New Jersey Agricultural Experiment Station (NJAES) has responded to Eastern U.S. strawberry growers' call for improved varieties for increased product value and economic returns by investing in a strawberry breeding program that prioritizes flavor. Several selections of the Rutgers breeding program have been identified for potential patenting and release. Through NSSI Phase I project successes, three selections were patented and two were licensed to commercial nurseries, including 'Rutgers Scarlet'TM. The focus of the NSSI Phase II project was to continue the effort to expedite the release of Rutgers-bred strawberry selections by working with 13 growers in on-farm evaluations of Rutgers-bred selections and commercial cultivars. Strawberries were tested on organic and conventional farms and in plasticulture and matted row systems. Replicated research trials at the New Jersey Agricultural Experiment Station, Pennsylvania State University, University of Maryland, University of Maine and University of Florida complimented the on-farm evaluation to offer statistically robust data and to test the selections

geographically. Another important area of this project examined the nutritional needs of the strawberry selections and the impact on yield and fruit quality through nutrient testing and by working with growers on plant nutrition management. Two commercial nurseries involved in the project offered the newly patented and released 'Rutgers Scarlet'[™] plants in 2015 and sold out of plants.

Project Outputs and Impacts

The project received a significant amount of media coverage with the release of 'Rutgers Scarlet'[™] reaching and increasing the awareness of an estimated 3.9 million people. This led to significant interest among consumers for 'Rutgers Scarlet'[™] and for locally grown strawberries. A local brewery even made a special strawberry beer by infusing 'Rutgers Scarlet'[™] fruit into the ale. Strawberry growers noted the increased sales and enthusiasm for local strawberries and had customers specifically asking for the new variety. Stephen Specca, one of the collaborating growers, commented, "Once [customers] came out and saw all of the crops we were growing, and experienced the taste of a fresh picked strawberry, they were hooked." Several growers commented that the Philadelphia Inquirer article boosted early spring sales, increasing profits by 10 to 20 percent in the early season. In addition to the hands-on experience of producing and observing the advance selections that 13 growers gained, nine of them also learned about tissue testing for nutrient status of their strawberry crop and were able to improve their fertility management. Nourse Farms Inc. and Kube Pak Corp, two commercial nurseries, sold out of 'Rutgers Scarlet'[™] strawberry in 2015. Nourse Farms sold over 100,000 plants to 22 states. Through on-farm twilight meetings led by project leaders, 154 farmers and industry professionals increased their knowledge of the new strawberry selections, in addition to tasting the fruit. More than 500 farmers, 100 Extension



Project leader Bill Hlubik shares 'Rutgers Scarlet'[™] strawberries with Fox 5 News NY correspondent Sharon Crowley. Photo by David Smela.



Project leader Peter Nitzsche of the Rutgers New Jersey Agricultural Experiment Station shows off a field trial of 'Rutgers Scarlet'[™] strawberries. Photo by Bill Hlubik.

educators and 270 master gardeners learned about the project and the strawberry selections through presentations at conferences and workshops, tours, twilight meetings, and interviews. This project also provided the opportunity for 10 university students to gain skills and expertise in various aspects of strawberry production and fruit analysis. Because of this experience some of the students have considered graduate school in horticulture.

Project Photos

Videos

- ["Improved Variety Selection of Strawberries for the Eastern U.S., Video 1"](#)
- ["Improved Variety Selection of Strawberries for the Eastern U.S., Video 2"](#)

Notable Press

- The Philadelphia Inquirer. ["A Special Jersey-bred Fruit is Berry, Berry Good"](#) (May 18, 2015)
- The New York Times — Food. ["To Delight: The Strawberry Patch Has a New Resident"](#) (June 1, 2015)
- NJ.com ["New Jersey Fruits Meet Local Brewery: Discover Rutgers Strawberry-Infused Beer"](#) (June 12, 2015)
- CBS New York. ["Rutgers Scientists Create New Strawberry To Wow Your Taste Buds"](#) (May 26, 2015)
- NJ.com ["Now That's a Strawberry! Taste Testing the New Rutgers Scarlet Strawberry"](#) (May 15, 2015)

Grower Profile

Jess Niederer – Chickadee Creek Farm

Pennington, New Jersey

“On-Farm Performance and Nutrient Requirements of New Strawberry Varieties for the Eastern United States”

Project Leader Peter Nitzsche and Bill Hlubik, Rutgers Cooperative Extension

Jess Niederer is the 13th generation of Niederer farmers, with four in this country and the rest back in Switzerland. She started Chickadee Creek Farm in 2010 on 17 acres of hayfield that was part of her family’s farm in Pennington, N.J. She transitioned the land to organic management and raises vegetables, strawberries, flowers, and herbs. The farm sells at six farmers markets and also operates a market-style CSA, in which subscribers pre-pay for produce at a discounted rate. CSA members also receive the benefit of being able to come pick strawberries on the farm.

Strawberries have been a gradually increasing part of the farm since 2010, and Jess currently has a half-acre in plasticulture production. The plastic mulch helps reduce disease and weed pressure, which is important for organic management. Jess grows strawberries on a four-year rotation, and has found the major challenges to be anthracnose and gray mold. She grows the cultivars Chandler, Jewel, Sparkle, Earliglow, AC Wendy and Rubicon, all planted in summer from bare-root plants. After their first harvest season, she then holds plants over for a second year, generally reserving the larger first-year berries for pre-pick and opening the second-year plantings to pick-your-own.

When Jess met Rutgers project leader Peter Nitzsche at an Extension meeting and learned that the project was eager to trial its New Jersey selections on organic farms, she quickly volunteered. Researchers came out to the farm and planted 300 feet of row (600 plants) of three selections. “All we had to do was provide bed space,” Jess said, “though we did end up helping them plant, by bringing out our waterwheel planter. My role was mostly observational. I wasn’t asked to do any recordkeeping.”

The research planting was established somewhat late (in September), so it was hard to make any direct comparison



New Jersey farmer Jess Niederer has been growing organic strawberries since 2010 on her 17-acre farm in Pennington. Photo courtesy of Jess Niederer.



Niederer partnered with the Rutgers Cooperative Extension to trial the new strawberry cultivar Rutgers Scarlet™ on her farm. Photo courtesy of Jess Niederer.

to her other varieties which had an earlier start. “The plants are doing fine, though,” Jess said. “The berries are incredibly flavorful, with a distinctly different flavor. There’s one I would contemplate growing if it is available commercially.”

She can already see the market potential for a new Rutgers strawberry. “The Rutgers University communications department did a remarkable job putting out the word about the trials, including the names of farms that were participating, and we had people asking for the new ‘Rutgers Scarlet’™ strawberry by name. That doesn’t happen with too many vegetables or fruits! The New York Times even asked Rutgers to send some samples so their food reviewer could try them. We only had a few berries from the trial, but what Pete [Nitzsche] emphasized, and I think is really true, is that if farmers can be a bit clever, you still have your moment of captive audience and should be able to benefit from it.”

Jess would be interested in participating in further variety trials. “I am thrilled that they included organic growers in the trials, so we can start to get a sense of what will perform best in each system.”

Grower Profile

Dave Specca – Specca Farms

Springfield Township, New Jersey

“Improved Variety Selection and Sustainability of Strawberries for the Eastern United States”

Project Leader Peter Nitzsche and Bill Hlubik, Rutgers Cooperative Extension

Specca Farms is a 50-acre, third-generation farm in south-central New Jersey, operated by Dave Specca, his wife, Lisa, and their two sons. It's almost entirely pick-your-own, offering crops from March through December — beginning with over-wintered spinach and spring greens, then selling a full range of tomatoes, peppers, squash and beans in the warmer months, and finishing up with collards, kale and Brussels sprouts in late fall. The farm is open Thursday through Saturday and draws people from as far away as 60 miles, with some traveling from Philadelphia, Delaware or Staten Island.

“We added plasticulture strawberries back in 2002,” Dave explained. “We already had the equipment for plasticulture, because we were using it for some of our vegetables.” They mostly grow the cultivar Chandler with some Sweet Charlie, typically keeping a planting for two years of harvest. In 2014 they had a half-acre of strawberries and have since added another half-acre for the 2015 season. They buy their tips from Canada and grow their own plugs, aiming for a planting date of early September.



Project manager Jessica Buitrago evaluates the performance of strawberry lines at Specca farms. Specca partnered with Rutgers Cooperative Extension in 2013 to trial 20 strawberry lines that had been developed by Rutgers breeder Goyko Jelankovick. Photo by Richard Weidman.



Third-generation farmer Dave Specca owns and operates a 50-acre pick-your-own vegetable farm with his wife and two sons in Springfield Township. He added strawberries to the operation in 2002. Photo by David Smela.

Specca partnered with Rutgers Cooperative Extension in 2013 to trial 20 selections of strawberry lines that had been developed by Rutgers strawberry breeder Dr. Goyko Jelenkovic, but never fully evaluated or brought to commercial release. Dave devoted a section of his strawberry field to the trial, putting up a fence and signs so that his pick-your-own customers wouldn't wander into the research plots. Project leaders Peter Nitzsche and Bill Hlubik of Rutgers Cooperative Extension planted the test cultivars and then returned to harvest and weigh the crop during harvest season.

“The experimental varieties were planted a little late, by about two weeks,” Dave said, “but I thought that in general they looked good and tasted better than ‘Chandler.’” Researchers hosted one field day where other New Jersey strawberry growers could also view and taste the selections — and also sample some jams from each variety.

Dave plans to continue to grow strawberries. The crop brings in a different group of customers than the first- and second-generation immigrants that make up much of his customer base, and he hopes that the new customers drawn in by strawberries will come back for his other produce throughout the season. Dave decided to work with the Rutgers team on the variety trial for a second year and he was able to grow plugs of the selections along with his standard varieties so that he can directly compare performance. The California-developed cultivar Chandler has been the mainstay of East Coast strawberry plasticulture for more than 30 years, and finding a replacement would be of tremendous benefit to Eastern growers. “I'm hopeful,” Dave said.



Strawberries are transplanted into beds at the Plant-It-Forward Farm in Houston, which offers economic opportunities to refugees in the Houston area. Plants were provided by the Texas Strawberry Project. Photo by Russ Wallace.

TEXAS

Increasing Grower Market Potential and Consumer Preference for Locally Grown Strawberries through Strategic Extension Programming in Texas

Project Leaders

- Russ Wallace, Texas A&M AgriLife Research & Extension Center
- Peter Ampim, Prairie View A&M University, Sustainable Agronomist
- Juan Anciso, Texas A&M AgriLife Extension, Extension Specialist
- Joe Masabni, Texas A&M AgriLife Extension, Extension Specialist
- Larry Stein, Texas A&M AgriLife Extension, Extension Specialist

Project Collaborators

- Prairie View A&M University — Billy Lawton, Brukendra Jackson
- Texas A&M AgriLife Extension — Monte Nesbitt, Mengmeng Gu, Marco Palma, Karl Steddom, Angel Fattorini, Vikram Baliga, Laura Miller, Dale Rankin, David Rodriguez, Daphne Richards, Skip Richter, Barbara Storz, Daphne Richards and Keith Hansen
- Texas Fruit Growers Association — Dan Rohrer

- Texas Vegetable Growers Association — Ray Prewett
- G&W Nurseries — Jim and Donna Goodson
- Growers — Kyle Barnett, Natalie Borchardt, Jeffrey Braune, Barbara Choate and James Zeig, Debbie Cline, Louis Duffield, Larry Jollisant, Joseph Mezher, Robert Mishler, Mike Moser and Bekki Callaway, James Moss, Jeff Nickerson, Collen O'Donnell, Saul and Diane Padilla, Katie and David Pitre, Russell Prince, Byran and Cindy Pruet, Lynn Remsing, Debra Rodriguez, Darren Rozell, Tim Smith, Craig and Karen Turley, Franklin Wagner, Amanda Watson, Ronnie Wheeler and Diann and Milton Woods.

Project Summary

This project brought together experienced and inexperienced growers and teamed them with county extension agents and marketing specialists to improve knowledge of small-scale strawberry production and sales in Texas. The project was designed to help determine whether small-acreage strawberry production can be expanded more widely across the state and whether growers are willing to take the risks of a new crop enterprise. The

economics of high tunnels, plastic mulch, irrigation, pest management and other associated labor costs were calculated and correlated with demonstration strawberry yields and current market prices in order to provide an economic assessment of strawberries in Texas. Various marketing strategies used by collaborating growers, including pick-your-own and roadside stands, CSA (Community Supported Agriculture), farmers markets and sales with local retailers, were analyzed to help determine which sales techniques are best suited to various farm sizes. This project began the collection of production, marketing and sales data needed to produce a “Texas Small-Acreage Marketing and Sales Guide” that will benefit growers and will be a companion guide to the Phase I publication, [“Production Guide for Texas-Grown Strawberries.”](#) In addition, the major events of this project, along with grower and other collaborator interviews, were recorded, compiled and edited into a video of the [Texas Strawberry Project: Phase II](#). The workshops, field demonstrations, field days, conferences and team collaboration helped teach and enhance sustainable strawberry production principles, strengthen communication between stakeholders, and alleviate small-acreage grower misconceptions regarding such an undertaking.

Objectives of the project were to enhance strawberry production in Texas using plasticulture and working with small-acreage growers; to enhance the knowledge and understanding of strawberry production in the state with County Extension Agents working closely with growers and marketers; to increase the competitiveness of growers by improving their choices of marketing strategies; and to understand the various factors that go into deciding whether or not to grow strawberries in the various climactic regions throughout the state.

Project Outputs and Impacts

There continue to be high levels of excitement for locally grown strawberries in Texas because of the success, exposure, and information generated by this project. The increased awareness of strawberries as a viable option for small-acreage growers in Texas has been a direct result of this project. Media outreach was fundamental in getting the exposure of the strawberry project to stakeholders across the state. More than 150,000 contacts were made through TV, radio, newspaper, newsletters, and blogs. Field days with on-farm demonstrations across the state were highly effective in getting exposure directly to other growers interested in strawberries. On-farm demonstrations successfully equipped growers with the tools and information needed



New strawberries varieties like ‘Sahara’ shown in the photo are being tested for Texas high tunnel production. Photo by Russ Wallace.

to continue to pursue strawberry production as a viable farm enterprise. Ninety-one percent of surveyed grower-collaborators who participated in the project responded that growing strawberries was worth the added effort, and 55 percent of the surveyed growers have plans to increase their acreage in the coming season. For 60 percent of the

growers, strawberries led to an increase in farm sales. Also, growers in areas where there is currently no strawberry production have expressed a desire to begin growing strawberries, which will continue to expand the acreage devoted to strawberry production in Texas. The High Tunnel Conference and Strawberry Grower Meeting were both well-attended, with growers expressing an interest in continuing the strawberry program in Texas. Because of this feedback, funding is being pursued to continue to support the growth of the Texas strawberry industry and to develop best management practices for organic strawberry production.



High tunnel strawberry production is demonstrated at the Texas A&M AgriLife Research and Extension Center at Lubbock. Photo by Russ Wallace.

Publications

- [“Production Guide for Texas-Grown Strawberries”](#)

Websites

- [Facebook Page](#)
- [Project Photos](#)

Videos

- [“The Texas Strawberry Project, Phase 2”](#)

Grower Profile

James R. Moss – Moss Farm

Hempstead, Texas

“Increasing Grower Market Potential and Consumer Preference for Locally-Grown Strawberries through Strategic Extension Programming in Texas”

Project Leader Russ Wallace, Texas A&M AgriLife Research & Extension Center

James Moss has always had an interest in agriculture. As a lifelong gardener, he worked on farms growing up and used his military service overseas as an opportunity to learn about farming in other parts of the world. When he retired in 2012 after 22 years with the U.S. Postal Service, he decided to become a full-time farmer. Attending a Southern Sustainable Agriculture Working Group (SAWG) conference and becoming involved in the Texas Organic Farmers Association were key in his decision. And his own experience with cancer made him especially interested in farming organically. He now operates a diversified small farm with sheep, chickens, and an acre of produce.

“When I became involved in the project,” James said, “I had never grown strawberries. I had not even contemplated raising them.” But he attended the Texas Strawberry Project meetings and did a lot of research on his own via the internet. The first year, with plants, plastic and drip tape fittings supplied by Texas A&M AgriLife Extension, he set out 875 plants of seven varieties to compare their performance. Even more importantly, he was learning the basics of strawberry production, including irrigation management, frost management with row covers, and use of tissue sampling to monitor fertility.



Strawberries are one of several crops that Moss grows in his high tunnel. The Texas Strawberry Project provided Moss with the resources and information he needed to get started with strawberries. Photo by Russ Wallace.



James Moss shows his high tunnel strawberries to Dr. Peter Ampim and Dr. Billy Lawton of Prairie View A&M University. Photo by Russ Wallace.

His organic fertility program included oyster shells, mushroom compost, a blended organic fertilizer, and compost tea. He also made a point of keeping the plants picked clean of dead leaves and damaged berries to reduce pest and disease pressure. He had some mites, but the biggest pest challenge was bird damage. “We had to cull lots of berries, probably a third of the crop [because of the birds],” James said. He sold his berries at farmers markets, a food coop in Austin and to Prairie View A&M University. “Customers love them,” James said, “and there are not a lot of producers nearby.”

James decided to participate in the strawberry project for a second year and expanded his production to a total of 2,400 plants, with some of them supplied through Extension and others that he bought on his own. He decided to invest \$4,000 in a plastic mulch layer, which he can also use on his other crops, and he experimented with using slit-plastic covers on low tunnels to protect the strawberry plants from January to March.

The unprecedented amount of rain in Texas this spring led to setbacks, however. “I had some beautiful flowers under the covers,” he commented. “Then I took them off and the rain came and we had *Botrytis* everywhere.” The experience made him think that growing his strawberries under a high tunnel would make the operation more profitable. And he’s finding his expanded planting too much for him and his wife to harvest on their own. But he knows he’s raising the plants better this year than he did the year before. And his own experience makes him very clear about this advice to other first-time growers attempting to raise strawberries organically: “Make sure you have resources and sources for soil building *before* you get started — you need to be able to add *good* quality organic matter to your soil.”

Grower Profile

Ronnie Wheeler – Wheeler Farms

Poteet, Texas

“Increasing Grower Market Potential and Consumer Preference for Locally Grown Strawberries through Strategic Extension Programming in Texas”

Project Leader Russ Wallace, Texas A&M AgriLife Research & Extension Center

With 15 acres of strawberries, the Wheelers are the largest strawberry producers in the Poteet area. Ronnie Wheeler has been growing strawberries for 30 years, farming land where his father-in-law started strawberries in the 1950s. The Wheelers sell their berries on the farm, at seasonal roadside stands, and at a farmers market, but their largest buyer is the Texas grocery chain H-E-B. Wheeler Farm strawberries have even been featured in a commercial for H-E-B Creamy Creations Poteet Strawberry Ice Cream. The Wheelers also grow 50 acres of vegetables and 10 acres of blackberries, primarily for the wholesale market.

Ronnie uses production practices that are traditional for the Poteet area — planting bare root strawberry plants onto raised beds without plastic mulch, using overhead irrigation to get plants established, and then relying on furrow irrigation through the growing season. He practices crop rotation instead of fumigation and usually has few pest and disease problems. The harvest season varies year to year, but it can start from early February to late March and last until mid-May to mid-June. The farm employs 15



Wheeler grows 15 acres of furrow-irrigated strawberries, making his the largest strawberry farm in the Poteet area. Photo by Russ Wallace.



Ronnie Wheeler's wife, Linda, holds up strawberries grown on Wheeler Farms. Photo courtesy of Ronnie Wheeler.

to 20 workers, including some who have worked there many years, but having enough labor is always a problem.

Wheeler partnered with the Texas Sustainable Strawberry Project in 2013 and provided a quarter-acre for variety trials. Of the eight cultivars in the trial, two were his current cultivars of choice — Albion and Camino Real — and three were cultivars he had never grown before — San Andreas, Radiance and Benicia. Ronnie agreed to keep harvest records of the trial. “I told them it was going to be a major problem when we got busy,” he recalled, “but we kept up pretty well, until near the end.” It was a good year; the project went smoothly, and he was impressed with two of the new cultivars, San Andreas and Benicia. The trial also gave him a chance to explore different production systems, including drip tape and plastic mulch.

Ronnie continued to work with the Strawberry Project for a second year, this time planting ‘San Andreas’ on different types of plastic mulch to see if a specific mulch type would be better suited to his area. But this year didn't go as well as the previous one. There was an issue with the quality of the strawberry plugs that A&M had received and many plants had to be replaced. The plugs were also infected with anthracnose, which was difficult to control due to the constant rains in the spring.

But Ronnie has a long-term perspective and he knows there will be good years and bad. He figures he will mostly keep on doing what he has been doing, possibly working in those new varieties. For the time being he will stick with bare ground and furrow irrigation, not convinced that plasticulture and drip are an improvement for him. “Our strawberry crop is a relatively short season compared to California,” Ronnie noted. It's hard for him to justify the additional expense, he said, and a bad year like this, with a perfect storm of weather and disease, is a reminder that keeping production costs down also reduces risk and financial loss.

Grower Profile

Diann and Milton Woods — Millie's Barn Veggie Farm

Eagle Lake, Texas

"Increasing Grower Market Potential and Consumer Preference for Locally Grown Strawberries through Strategic Extension Programming in Texas"

Project Leader Russ Wallace, Texas A&M AgriLife Research & Extension Center

Diann and Milton Woods have been farming since 1998 on a 12-acre farm that has belonged to Diann's family since 1908. This land in the flat, sandy Coastal Bed region of Texas, an hour drive from Galveston, had never been farmed except to graze a few cattle. Farming is a retirement venture for Diann, who worked as a dietician and nutritionist, and for Milton, who had a career as a civil engineer. Said Diann, "I felt like something is wrong in the food chain, let's see what I can do about it."

The Woods utilize organic and biodynamic methods, intensively cropping 10 acres devoted to a variety of vegetables, fruit trees, blackberries, and olives. They also raise a small flock of laying hens and broilers. They sell the farm's produce and eggs through a 25-member CSA and to local restaurants and grocery stores.

Diann and Milton had already been working closely with Prairie View A&M University for advice and information in their other ventures, and were thinking of expanding into strawberries when they attended a meeting about the Texas Sustainable Strawberry Project. They quickly decided to participate.

The project provided them with 1,000 plants of six cultivars — Chandler, Camarosa, San Andreas, Albion, Strawberry Festival, and Benecia — for a variety trial to see which would perform best under various conditions throughout Texas. Diann, an inveterate experimenter, purchased 1,000 more plants of five more cultivars on her own to add to the trial, including some alpine and white "pineapple" strawberries.

This was the Woods' first experience with plasticulture. They decided to



Diann Woods plants strawberry plugs for a variety trial with the Texas Strawberry Project. Photo courtesy of Diann Woods.

purchase their own mini-mulcher to shape the beds and lay drip tape and plastic mulch. They then planted by hand, dipping each plant in a seaweed-molasses tea and placing an organic fertilizer mix in each hole.

Diann found the project meetings very helpful. "I was very impressed with the way they brought out the pros and cons. And we took a course so we could learn what would happen throughout the year. We also had field days at each other's farms, and we all discussed what happened and what we did." She also did research on her own to find organic products she could use to fit strawberries into their operation.

Their plants grew well and they had no problems except for deer. They planted a fava bean cover crop between the strawberry beds, which provided a windbreak and shade in the spring. Their harvest started in December, peaked in February, and finished in April when it got hot. They kept yield records for each variety in the trial and Diann figures she averaged about 1.5 pounds of fruit per plant. She was able to price the berries at \$5 per pound and also made jam to sell out of the strawberries that were left over.



Milton Woods works on the plastic mulch layer, which the Woods purchased to make their strawberry beds. Photo by Justin Duncan.

The Woods decided to participate in the project for a second year and have expanded their planting to a half-acre. It includes the favorites of the cultivars in the trial, Festival and Camarosa, plus Camino Real and Chandler. And they now have a 10-foot fence around the four-acre field that contains the strawberries to keep out their four-footed marauders. Diann looks forward to the continuing networking and discussion within the project.

OTHER GROWERS

Grower Profile

Ian Greene – Production R&D Manager, Pacific Berry Farms

Watsonville, California

Phase I Project: “Sustainable Strawberry Production in the Absence of Soil Fumigation”

Project Leader Thomas Gordon, University of California at Davis, with graduate student Margaret Lloyd

Ian Green is a research agronomist for Pacific Berry Farms, which manages 1,200 acres of strawberry production throughout California under contract to various shippers, including Earthbound Farms. When Ian was contacted by graduate student researcher Margaret Lloyd, he knew that both Pacific Berry Farms and Earthbound Farms would be glad to cooperate. “Research by the University of California makes a big difference to the strawberry industry,” Ian said. He was already impressed by the work that both Margaret and project leader Thomas Gordon were doing with compost in strawberry production.

The site chosen for this field study was the Hayes Organic Ranch located in Watsonville, a 25-acre organic farm that grows strawberries for Earthbound Farms. Ian and farm employees worked with Margaret to evaluate four commercial composts — manure compost, yard trimmings



Strawberry field trial in Watsonville. Photo by Margaret Lloyd.



Ian Greene collects data from the compost study. Photo by Margaret Lloyd.

compost, spent mushroom compost and vermicompost. The compost treatments were applied in four random replications before strawberry beds were shaped and covered in plastic. Strawberry cultivars Albion and Chandler were grown in the research plots under the same production practices as the rest of the field.

The researchers provided scales, record books, and a weighing table. Ian was responsible for making sure the berries were picked in a timely way, that yield data was collected for each plot at each picking, and that the data was sent to Margaret Lloyd weekly. He also had to assure the cooperation of field supervisors; since they are focused on harvesting berries efficiently, having a research planting within a field can slow them down. “We had two workers who were assigned and trained to pick the research plots and collect the data,” Ian said, “and we worked it out that these workers were allowed to pick slower but got the same rate of pay as if they were doing piece work like everyone else.” The farm was then able to sell the research berries along with the rest of their harvest.

Ian estimates that the cost to Pacific Berry Farms for his time and to Earthbound Farms for the extra labor was close to \$6,000. “It was a lot of work but we felt that if there was good information to come out of it, we wanted to be part of it. It’s a win-win arrangement for everyone.” He expects his farms to continue to be involved in this kind of research. “We are interested in two things — yield and quality — and will be watching for results that show best results most economically,” Ian said.

Grower Profile

Jerry Wohletz – Wohletz Farm

Lawrence, Kansas

Phase I Project: “Development and Adoption of Annual, Plasticulture Strawberry Production in the Great Plains”

Project Leader Cary Rivard, Kansas State University

Jerry Wohletz farms 80 acres in Lawrence, Kansas, where he and his wife have been raising cattle and four acres of produce since they moved there in 1996. They grow a wide variety of vegetables, plus flowers, selling primarily at the Lawrence Farmers Market. Jerry started raising strawberries on plastic in 2009, after meeting some Missouri and Arkansas growers at a southern Missouri field day. “I was looking for something new and different,” he said. Annual plasticulture offered the possibility of larger berries, higher yields, and easy picking for pick-your-own, and didn’t require using his limited water resources to keep plants alive during the hot summers.

Because the winters in their area are harsher, however, Jerry found it was more difficult to get a large enough crop to be profitable following the practices used in Missouri and Arkansas. He worked with Cary Rivard, fruit and vegetable specialist at Kansas State University, to apply for and receive a Sustainable Agriculture Research and Education (SARE) Producer Grant in 2011 to study the effects of various weights of row covers and the best timing to apply the row covers as winter protection for the berries. The National Strawberry Sustainability Initiative (NSSI) allowed them to continue the project, expand the research



Strawberry plugs are planted into plastic mulch at Wohletz Farm. Photo courtesy of Jerry Wohletz.



Row covers are removed from strawberries at Wohletz Farm. Photo courtesy of Jerry Wohletz.

to university plots and add another farm cooperator. The NSSI grant helped purchase thousands of dollars of temperature probes to collect microclimate data on all sites.

With only a few years of data — and an extremely harsh winter in 2014 — results are not clear-cut, but still instructive. They now know that using row cover is essential and they are seeing a benefit to using somewhat heavier covers (1.2 to 1.5 ounces). “Our biggest concern using covers was that if the covers were too heavy, the plants would come out of dormancy too early,” Jerry said. Their data loggers are revealing instead that heavier covers actually moderate the temperature in early spring, helping avoid heat spikes. Heavier covers are also providing a slight increase in yields. Jerry noted, “An increase of 0.05 lb. per plant doesn’t sound like a lot, but over 16,000 plants per acre that translates into \$1,500 of value per acre.” They’ve also learned that covering earlier is advisable — and that early cold snaps need to be taken seriously.

What has been especially impressive for Jerry Wohletz is the outpouring of consumer enthusiasm for the strawberries. They could easily sell more, and customers don’t balk at pick-your-own prices of \$2.50 per pound and farmers market prices of \$7 per quart. This year, with a short crop because of freeze damage, Jerry found he had to deal with long rows of cars lining up before opening time as customers tried to be sure they could get berries.

Several other Kansas growers who attended field days sponsored by the project now have half an acre to an acre of strawberries planted. Although the grants have ended, research and networking among farmers will continue, because the growers and Dr. Rivard all recognize the importance of figuring out the best practices for their climate. There is lots of room in the marketplace for growth. Over the next few years, the strongest factor in building Kansas strawberry production may be the commitment of growers to research, networking and information-sharing.

Grower Profile

Tom Baker – Brookdale Farm

Virginia Beach, Virginia

Phase I Project: “Strawberry Grower Education and Adoption of Research Innovations: Technology Transfer of Production Recommendations”

Project Leader Penelope Perkins-Veazie and Jeremy Pattison

The strawberry cultivar Camarosa has become popular with Southeastern growers in recent years. ‘Camarosa’ strawberries have a longer storage life than the long-popular ‘Chandler,’ but yields can be disappointing in cooler areas. Dr. Jeremy Pattison’s previous research had shown that putting row covers on ‘Camarosa’ in the fall would increase floral initiation and lead to higher yields in the spring. He had developed a model, based on the accumulation of heat units by the plants, as a way to help know when to apply and remove the covers, and wanted to try it out on multiple farm locations.

Tom and Anne Baker of Brookdale Farm in Virginia Beach were among several Virginia farmers who participated in the strawberry project led by Dr. Pattison and Dr. Perkins-Veazie. The Bakers have been raising strawberries since 1997. They have two locations, 12 miles apart, with one acre on their home farm and 1.5 acres on their other farm, and sell their strawberries almost entirely as pick-your-own. They also raise sweet corn and pumpkins. School field trips in the spring and fall have become a major part of their business, as well.

Each farm participating in the project received data loggers and row covers. Tom set out four data loggers, two at each farm, with one under the cover and the other in the open. “We started using them after transplanting, to see how many heat units had been accumulated,” Tom explained. When the temperatures dropped so weather itself was not providing enough warmth, they applied the row covers, and then removed them after enough heat units had accumulated. Tom continued to use row covers throughout the winter, taking them off if there was a warm spell, and then using them for frost protection in the spring.

The data loggers needed to be downloaded at least every 60 days onto a laptop with special software, so Virginia Beach Extension agent Roy Flanagan went to each farm to collect the data and passed it on to Dr. Pattison to analyze and use to advise the growers. And because the row covers provided by the grant were from a different manufacturer than the



Tom Baker, owner of Brookdale Farm. Photo courtesy of Tom Baker.

ones Brookdale Farm usually uses, they will also be able to compare how the different covers perform when that data is analyzed.

Tom thinks he saw some benefit from the row cover practice, but he also thinks it was not a year where the row covers would have been crucial because of warmer-than-average temperatures. “It is easy to know in hindsight what you should have done, but it is much harder to predict in advance whether it will be warm or cold in the fall or winter,” Tom noted. “It’s a moving target. Every year is different, and we were building our knowledge base and experience.”

Brookdale Farm had not grown ‘Camarosa’ before this project. “Being able to participate in the study encouraged me to go ahead and start raising that variety,” Tom said. Not only do the berries keep longer, but they also yield more steadily and some customers especially like them for making jam, he noted.

This year Tom has the covers and data loggers out again, repeating the experiment and working closely with agent Roy Flanagan. “Being able to look at your info on your own farm and in your field is the way agriculture is moving,” Tom said. “This grant helped everyone see the benefit of that.”



Extension agent Roy Flanagan collects data from weather stations at Brookdale Farm. Photo courtesy of Roy Flanagan.

APPENDIX OF RESOURCES

Publications

- [Economic Viability and Environmental Impact Assessment of Three Different Strawberry Production Systems in the Southeastern United States](#). Hort Technology 25:585-594. By Olya Rysin, Amanda McWhirt, Gina Fernandez, Frank J. Louws and Michelle Schroeder-Moreno, North Carolina State University.
- [Does Local Label Bias Consumer Taste Bud and Preference: Evidence of a Strawberry Sensory Experiment](#), by Chenyi He, Zhifeng Gao, Charles Sims and Xin Zhao, University of Florida.
- [On-Farm Evaluation of Sustainable Soil Management Practices for North Carolina Strawberry Production](#), by Michelle Schroeder-Moreno, Gina Fernandez, Yasmin Cardoza, Hannah Burrack and Amanda McWhirt, North Carolina State University.
- [Production Guide for Texas-Grown Strawberries](#), by Russ Wallace and Juan Anciso, Texas A&M AgriLife Extension.
- [Sustainable Practices for Plasticulture Strawberry Production in the Southeast](#), by Amanda McWhirt, Gina Fernandez and Michelle Schroeder-Moreno, North Carolina State University.

Tools

- [Interactive Strawberry Budget](#) with [user-guide](#), by the University of Arkansas System Division of Agriculture.
- [Conventional, Organic, and Compost Based Strawberry Budgets](#) with [tutorial video](#), by North Carolina State University Cooperative Extension.

Presentations

- [Cultivar Evaluations for Organic Strawberry Production in High Tunnels](#), Sanjun Gu, John Evan Beck and Joseph Aaron Moore, North Carolina A&T State University. American Society for Horticultural Science 2015 Annual Conference.
- [Distribution and Management of Spotted Wing Drosophila in Florida Berry Crops](#), by Oscar E. Liburd, University of Florida.
- [Off-season Weed and Sting Nematode Management for Organic Strawberry](#), Carlene Chase, Guilherme Braz and Tamika Garrick, University of Florida. American Society for Horticultural Science 2015 Annual Conference.
- [Promoting Adoption of Cover Crops for Weed Suppression by Broadening their Utility](#), by C.A. Chase, G.B. Braz and M.E. Swisher, University of Florida. Weed Science Society of America 2015 Annual Meeting.

- [Using Wireless Sensor Networks for Irrigation and Nutrient Management in Strawberry Production](#), by Bruk Belayneh and John Lea-Cox, University of Maryland. American Society for Horticultural Science 2015 Annual Conference.
- [The Influence of Fertilizers from Different Nitrogen Sources on Strawberry Production](#), Yurui Xie, Xin Zhao and Zack Black, University of Florida. American Society for Horticultural Science 2015 Annual Conference.
- [Willingness to Pay for Eco-labeled Fresh Strawberry: Are All Environmentally Friendly Techniques Equal?](#) By Xuqi Chen, Zhifeng Gao, Marilyn Swisher and Lisa A. House, University of Florida. Agricultural and Applied Economics Association 2015 Annual Meeting.

National Strawberry Sustainability Initiative Websites

- [Website](#)
- [Blog](#)
- [Photo site](#)
- [YouTube channel](#)
- [Facebook page](#)
- [Twitter feed](#)

[Center for Agricultural and Rural Sustainability](#), University of Arkansas System Division of Agriculture

Project Websites

- [Sensing Berries](#), University of Maryland
- [Sustainable Soil Management Practices for Strawberry Production](#), North Carolina State University
- [Texas A&M AgriLife — Prairie View A&M Sustainable Strawberry Project](#), Texas A&M AgriLife Extension and Prairie View A&M

Videos

- Arkansas — [Arkansas Sustainable Strawberry Production Video Series](#)
- Florida — [Sustainable Strawberries Research Project — Phase 2](#)
- Maryland — [Strawberry Fields Forever](#)
- New Jersey
 - [Improved Variety Selection of Strawberries for the Eastern US Phase 2](#)
 - [Improved Variety Selection of Strawberries for the Eastern US – Final Outcomes](#)
- North Carolina
 - [Views from the Field: Karma Lee](#)
 - [Views from the Field: Russ Vollmer](#)
 - [Views from the Field: JR Odom](#)
 - [Strawberry Research at CEFS: Field Views+ 2013-2014](#)
 - [Webinar: Incorporating Sustainable Practices into Plasticulture Strawberry Production](#)
- Texas — [Texas Sustainable Strawberry Project, Phase 2](#)

