

Developing a method to capture and authenticate single varietal honey on diverse landscapes

Final report for FNC15-1019

Project Type: Farmer/Rancher

Funds awarded in 2015: \$11,734.00

Projected End Date: 08/15/2017

Grant Recipient: Second Nature Honey

Region: North Central

State: Illinois

Project Coordinator:

[Maggie Wachter](#)

Second Nature Honey

Project Information

Summary:

WORK ACTIVITIES IN YEAR ONE (2015)

We began preparing for our SARE project in early March 2015 by moving ten hives of Italian and Russian bees into the apiaries of Curtis Orchard and Pumpkin Patch, a farm that features 20 acres of 30 varieties of apples. During the bloom from April 20 to May 3, the hives were physically transported into the apple orchards to facilitate pollination.

During the apple pollination, we monitored the honey bee pollination of the apples by "bee spotting" i.e. counting bees on the trees within a specified time (one to five minutes). Bee spotting revealed that our honey bees did not rush towards the apple blossoms. Rather they appeared to prefer the nearby cherry trees that were blooming at the same time.

Later in the summer, we conducted similar attempts to direct bees to wild forest crops, including groves of black locust trees (nearby Mahomet IL). We decided to include groves of sourwood trees because of the unique location of several hives in the Appalachian Mountains of North Georgia.

Our SARE project also included microscopic examination of pollen collected from flowers and honey bee "pollen loads", samples of pollen that were transported to the hives by honey bees. We taught ourselves the skill of identifying pollen using a microscope. In the early days of the SARE project, before acquiring a camera to photograph microscopic samples, we sketched microscopic grains of pollen. Later we used a Cannon Rebel T5 camera to photograph pollen grains through the microscope.

We also conducted some exploratory honey analysis in a University of Illinois laboratory. This included centrifuging samples of honey and examining them microscopically.

Another aspect of our project was to participate in the University of Maryland

Sentinel Honey Bee Project. We were required to mount two hives on scales and collect and send samples of bees from eight hives to the University of Maryland Bee Lab over a six month period (May to October) for analysis of mite loads and twelve common bee diseases.

RESULTS AT END OF YEAR ONE

One of the techniques that we used during apple pollination was to move the hives into the midst of the apple trees during the bloom. We noticed that each time the hives were moved, the hives were weakened because many foragers returned to the empty space where the hive once stood.

The results with the black locust blossoms were more successful because we applied the knowledge we gained from the apples: we used strong hives placed directly in front of the grove. These hives were moved far enough (over two miles) that the bees could not return to the old hive location, so they returned to the new hive location, keeping them strong. The resulting honey had the conventional appearance and taste of black locust.

Experimentation with bees in the sourwood trees was less clear. While the hives were strong and the sourwood grove was thick, the background forage in the Appalachian forest is immensely competitive. The resulting honey was darker than pure sourwood, but it had a wonderful flavor. We suspect that the unique flavor of the honey was due to its sourwood-wildflower composition.

We taught ourselves the skill of identifying pollen using a microscope. The blooms that we sketched or photographed in 2015 include red delicious apple, red haven peach, blueberry, dandelion, tulip poplar, white honeysuckle and sumac.

We also began a library of common pollen grains found on the farm. This year we either sketched or photographed pollen from the plants listed below. The purpose of the library is to provide a reference for eventually identifying pollen in honey.

The monthly health analysis of our bees by the Sentinel Honey Bee Project indicated that our bees were healthy and resilient. The Project consistently rated our bees on the high end of health compared with others. We hypothesized that the nutritious and diverse forage that is available on a small family farm contributed to the above average health of our bees. Research supports this hypothesis (Wheeler & Robinson, 2014).

Honey from our project was sold in the Curtis Farm Store and local farmers markets. Perhaps one of the best outcomes of the first year is that honey from the Curtis Farm received first place in the Central United States in the 2015 International Black Jar Honey Tasting Contest hosted by the Center for Honeybee Research. This confirms our hypothesis that honey produced on a diverse small farm is exceptional in many ways.

During the winter of Year One, we reviewed the effectiveness of our pollination attempts. We consulted the following experts to help us understand and adjust crop pollination for small farm landscapes:

Professional apple pollinator-beekeeper, Michael Palmer, advised that we saturate the apple orchard with twice the hive density, a minimum of one hive per acre. In a personal communication, Dr. Tom Seeley of Cornell University suggested using stronger hives. Dr. Deborah Delany of the University of Delaware pointed out that honey bees preferred high sugar content in nectar, speculating that the cherry blossoms might be higher in sugar than the apple blossoms. She also suggested that native bees might be useful pollinators for apple trees.

WORK PLAN IN YEAR TWO (2016)

In Year Two we approached apple pollination differently based on advice we

received from experts cited above. We doubled the number of hives to saturate the orchard. We planned to preserve the strength of the foraging populations by keeping the hives stationary, leaving them in their home apiary near the orchards but not moving them into the apple trees. We also planned to encourage a diversified pollinator population by building nests for native bees and placing them near the orchards. We hoped that the stronger and more numerous hives would result in improved bee spotting among the apple trees.

We continued to improve our skills in pollen identification and build a reference library of pollen grains from common farm plants.

We expected the excellent foraging available to our bees, either on a small, diverse family farm or in a wild Appalachian forest to continue to maintain a high level of honey bee health, as confirmed during our participation in the Sentinel Apiary Program (U. of Maryland) during Year One.

The capstone of our project was the production of a booklet outlining techniques to help small farmers and beekeepers in understanding the special requirements of pollination on small farm landscapes.

OUTREACH

We shared our project information through Facebook, television, radio, and tours. Chasing the Honey is the title of our Facebook page that specifically highlighted our grant project research. We have referenced Chasing the Honey to our business Facebook pages as well, Curtis Orchard and Pumpkin Patch and Second Nature Honey.

We sent out press releases of our SARE activities to local media. Television crews were eager to learn more about our project and beekeeping. We even had the opportunity on two occasions to suit up Fox News anchor, Janese Harris and her camera person to film the honeybees in action. This was broadcasted across central Illinois during two separate news segments.

Phillip Kisubika, Radio personality for WDWS NewsTalk 1400, braved his fears of being stung to join us on a bee sampling day. He was eager to see us in action and to capture the sound of a bee hive. Here is a link to the audio file [Bee research at Curtis Orchard](#) which is shared through our local newspaper's website.

Illinois Congressman Rodney Davis visited our apiary in Year Two to see our pollination success.

Lastly, we mentioned our grant to the many guests that attend our tours at Curtis Orchard. We have about 4,000 guests of all ages join our tours and our tour guides mentioned our grant during the honeybee portion of our tour. One tour of note was the SARE tour with about 35 people in attendance, including NCR-SARE Administrative Council members, State Coordinators, and staff along with University of Illinois staff. We were excited to share the progress of our research with those closest to the grant funding.

In the future, we will also send more press releases out in the hopes of generating additional news coverage. We will distribute our booklet to interested farmers, beekeepers and nature lovers. We have approached local educational venues about presentations, including Parkland College, Urbana Parks and Recreation and the University of Illinois Extension.

Annex A

Table of flowers with bloom periods, 2015

Name of crop	Quantity	Place	Date 1 st bloom	Date end bloom	Comments
Dandelions	10 acres	Curtis	April 15		observed bees on plants
Apples	5,000 trees, 25 acres	Curtis	April 20	May 3	cool and cloudy at bloom beginning
Black locust trees	200 trees on 1 acre	Mahomet	May 9	May 24	White and red honeysuckle nearby
Buckwheat	6x6 foot patch	Urbana	May 25	Start to go to seed in early July	Did not observe honey bees on crop.
Sourwood trees	forest w/ at least 300 sourwoods	North Georgia	June 30 2015		Bees very excited, working hard on July 3
Strawberries	5 rows, 15 ft long	Curtis	April 29		observed bees on crop
White & red clover	10 acres	Curtis	April-May 25		observed bees on crop
Black Raspberries	40 ft row	Curtis	May 17		observed bees on crop
Blueberries highbush	16 plants	Curtis	April 23	May 13	observed bees on crop
Cucurbits	20 acres	Curtis	July 14		observed bees on crop
Red raspberries	3 rows, 50, 28, 15 ft.	Curtis	July 26	August 6	observed bees on crop

REFERENCES

Diet-dependent gene expression in honey bees: honey vs. sucrose or high fructose corn syrup. Marsha M. Wheeler & Gene E. Robinson. Scientific Reports 4, Article number: 5726 (2014)

doi:10.1038/srep05726

Project Objectives:

By exploring methods for maintaining agricultural diversity while efficiently and effectively pollinating specific crops within a diverse environment of competing pollen and nectar sources, we will contribute to sustainably managed pollination of farm crops by honey bees as well as the production of varietal honeys. The methods we develop in this project to monitor nectar flows and authenticate honey will result in a Best Practices Guide for the sustainable production of varietal honey resulting in improved economic return for small-scale beekeepers.

Cooperators

- [Rachel Coventry](#)

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Research

Materials and methods:

Our two-year NCR SARE project was intended to explore crop pollination techniques in small farm environments. We hypothesized that pollination on small farms had a specific set of challenges that are different from large single-crop farms. Large farms often control pollination opportunities by presenting honey bees with a single choice, the target crop. Small farms, on the other hand, often present honey bees with a diversity of crops competing for pollination, as well as rogue wildflowers such as dandelions and clover. In Year One of the NCR-SARE grant, we investigated pollination practices that are commonly used in migratory beekeeping. We noted weaknesses in these practices on small farm landscapes.

Throughout the project we collected pollen from blossoming crops and studied it under a microscope. We planned to establish a small library of common pollen grains for comparison with pollen found in the hives. Our intent was to identify common pollen grains to help us track and identify successful pollination techniques.

During the winter hiatus, we talked to experts and researched pollination alternatives. In Year Two, we designed pollination practices to exploit the advantage of small farm landscapes for both honey bees and farmers.

Research results and discussion:

Pollination success was measured through observation of fruit set and harvest size. Photographs and drawings of pollen from the flowers of some apple varieties accompanied our pollination techniques.

The honey produced by the bees during the experiment was expected to exhibit varietal characteristics that were commonly attributed to the target crops. Instead we discovered that the honey from the diverse small-farm landscape was extraordinarily complex.

At the close of Year One, when we used conventional pollination techniques, we submitted honey produced from our NCR-SARE project to the black jar competition offered by the Center for Honey Bee Research. We (Rachel Coventry) were pleased to be selected as first place winner for Central Region of the USA. When we submitted our honey from Year Two, after using pollination techniques specifically adapted to small farms, we (Rachel Coventry) were awarded the Center for Honey Bee Research's grand prize, "Best Tasting Honey in the World". We attribute this accolade to the diversity of crops, both wild and cultivated, that lent our honey its natural, multidimensional flavor.

As for crop production, the farmer on our apple farm estimated the number of pollinated flowers by cutting a sample of the apple ova in half after petal fall to see if they had been pollinated. While the crop in the first year was considered good, the second year crop was considered very good, even though it coincided with a program of replacement of older trees with younger trees that were not yet productive. In the second year there was also a frost that damaged many king blooms, those that would yield the largest apples. In spite of these unexpected events, the second year apple crop was more plentiful to the point that the farmer ruefully remarked that additional thinning would have been appropriate.

Participation Summary

2 Farmers participating in research

Educational & Outreach Activities

30 Consultations

2 Curricula, factsheets or educational tools

15 On-farm demonstrations

8 Published press articles, newsletters

100 Tours

15 Webinars / talks / presentations

8 Workshop field days

PARTICIPATION SUMMARY:

225 Farmers

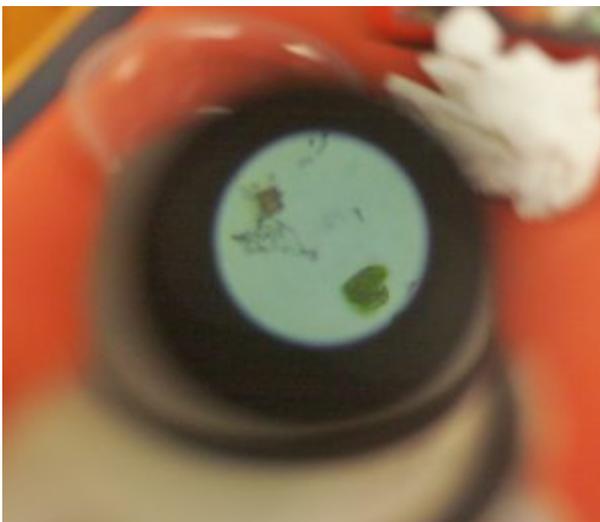
25 Ag professionals participated

Education/outreach description:

Press releases, presentations, and other documents:

- [Rachel-Coventry-visitor-guide-bio-2017](#)
- [Farmers-Forum-Presenters-Title-Slide-2017](#)
- [New-Gazette-Maggie-Wachter](#)
- [DAR-IL-state-conference-program-back](#)
- [DAR-IL-state-conference-program-center](#)
- [Champaign-County-Visitors-guide-rachel](#)
- [DAR-Honeybee-presentation](#)
- [SAATFinalReport2015-1](#)

Images:







NEW
The Secret Life of Honey
 Why is honey considered a "super food"? What's the difference between raw, organic, and natural honey? Meet beekeeper and author Maggie Wu for this special feature, including information and research about how honey might benefit your complexion, your gut, and your immune system, and why it's one of the most versatile and nutritious substances on earth.
 Thursday, 7/27 6-8pm
 Bookstore 444-41 437
 \$12.00/Adult
 \$7.00/Child

Beekeeping Kickstart!
 Beekeeping is a fun hobby that can be done for the whole family. Join us for a hands-on kickstart to beekeeping. We'll cover the basics of beekeeping, including how to choose a hive, how to manage a hive, and how to harvest honey. We'll also have a Q&A session with a local beekeeper. This is a great opportunity for anyone interested in beekeeping and honey.
 Tuesday, 7/24 6-8pm
 Bookstore 444-41 437
 \$12.00/Adult
 \$7.00/Child

Summer Cocktail Party
 Join us for a special evening of cocktails and conversation. We'll have a variety of drinks and a menu of light bites. This is a great opportunity to meet new people and enjoy the summer season.
 Thursday, 7/27 6-8pm
 Bookstore 444-41 437
 \$12.00/Adult
 \$7.00/Child

NEW
Honeycomb Night
 Learn the secrets and stories behind the honeycomb. We'll have a special presentation on the history of honey and how it's used in various cuisines. This is a great opportunity to learn more about this amazing natural product.
 Thursday, 7/27 6-8pm
 Bookstore 444-41 437

Pickle It!
 Pickle up your summer with our new book, "Pickle It!". This book is a guide to pickling, from basic recipes to more advanced techniques. It's a great resource for anyone interested in pickling and preserving.
 Thursday, 7/27 6-8pm
 Bookstore 444-41 437

Let's Start Composting
 Join us for a hands-on session on composting. We'll cover the basics of composting, including how to choose a compost bin, how to collect and manage compost, and how to use it in your garden. This is a great opportunity to learn more about this eco-friendly practice.
 Thursday, 7/27 6-8pm
 Bookstore 444-41 437





Our project was publicized through press releases and media appearances. It was also publicized through inclusion in 6 beekeeping classes at the local community college, totaling 35 students. It served as the basis of an academic thesis submitted to Dr. Jamie Ellis and his review committee at the University of Florida (Gainesville), for which Maggie Wachter was presented with Master Craftsman in Beekeeping certificate before an audience of 200 people. Curtis Orchard hosted over 100 tours to school children, seniors, and special interests groups from 2015 through 2016 all were directly informed about the work Curtis Orchard does

through beekeeping and SARE grant research. Furthermore, Rachel Coventry shared our SARE grant work with a Champaign Illinois Farm Bureau teachers workshop in 2017, radio interviews locally and RFD radio broadcasts, local newspapers, and the Illinois Specialty Growers News publication. We were even given the opportunity to share our passion for beekeeping and our grant research with Congressman Rodney Davis when he visited Curtis Orchard May 9. The pictures above depict the swarm we were able to capture with him.

Future communications: We feel that our findings can benefit farmers and beekeepers throughout the United States. The booklet produced by the SARE grant summarizes the findings of our research. It will be used to support presentations at beekeeping and farming conferences.

Press releases, PowerPoint, and other documents related to outreach have been uploaded in media file.

Learning Outcomes

12 Farmers reported changes in knowledge, attitudes, skills and/or awareness as a result of their participation

Lessons Learned:

At the start of the project, Rachel Coventry and Maggie Wachter were both experienced beekeepers. However, honey bee pollination was an area where both felt eager to learn more. The two year grant provided a rare opportunity to team up together to test the success of conventional methods and think outside the box, to adapt pollination practices to small farms, which are often overlooked by migratory beekeepers. At the conclusion of the grant, both beekeepers felt comfortable and confident with the pollination techniques that they had tested and adapted during the grant, specifically for small farms.

Beside the teamwork that was built while carrying out the terms of the grant, Rachel and Maggie also built trust and appreciation of their mutual beekeeping skills. One of the surprising benefits of the NCR-SARE grant was that working together helped them both grow as beekeepers.

Beekeepers often work in isolation and Rachel and Maggie barely knew each other when the project began. However the Curtis family farm offered a supportive environment for developing mutual cooperation. Now Rachel and Maggie continue to work together on various beekeeping projects. They bounce ideas for handling hive challenges such as mite treatment, honey bee temperament, and nutrition. When Rachel broke her leg, Maggie helped harvest honey. When Maggie needed a specific piece of equipment, Rachel had it. They often place orders for beekeeping supplies together. Thanks to the NCR-SARE grant, they have developed a network that increases their effectiveness in supporting the economic objectives of the farm and improves the the resilience of their honey bees.

The NCR-SARE grant was an exceptional experience for Rachel and Maggie both professionally and personally.

Project Outcomes

3 Farmers changed or adopted a practice

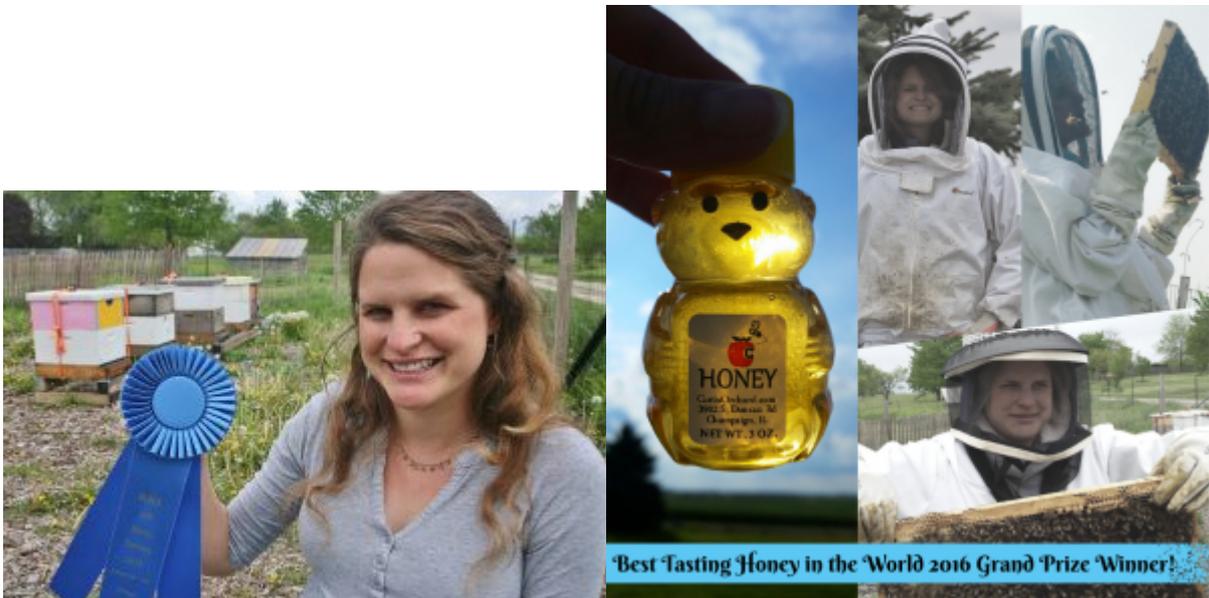
7 New working collaborations

Success stories:

In the first year of the project, Rachel Coventry entered a honey contest organized by the Center for Honey Bee Research. The honey was produced by honey bees located in the NCR-SARE bee yard. Rachel was gratified to receive the prize for best honey in the Central Region of the USA. The following year, the second year of the NC-SARE grant, we changed our pollination practices to improve honey bee health (stronger hives, less stress and fewer bee losses due to stationary pollination). Rachel submitted her honey again and was awarded the grand prize, World's Best Honey.

On the website of the Center (<http://www.chbr.org/HoneyContest.aspx>), she attributed her success in part to the diversity of crops and her work analyzing flower sources during the grant period.

“The primary early nectar source entering our honey is apple. The 2016 crop year provided a heavy apple bloom and optimal weather for foraging. Eight other small fruit crops on our farm influence the honey by providing unique fruity tones. Wildflowers, red and white clover and dandelion’s in our region round out the complex blend of flora available to our bees. Each year our honey carries a light golden color and a rich mellow flavor as its trademark. For the last two years, I have attempted to analyze the flower sources most visited by our bees. I did this by combining bee spotting with microscopic analysis of the pollen carried to the hive, and verifying my observations through the use of a pollen catalogue. All of us at Curtis Orchard are incredibly honored that our honey was the winning selection in this prestigious world competition.”



Recommendations:

Our research incorporated previous SARE research on using native bees for apple pollination (2013, OS13-074). In 2016 we also participated in a webinar by Michigan Extension on using native bees for pollination. These sources led us to speculate that future research might examine the success rate of pollination using both honey bees and native bees.

Our research suggests a strong connection between stationary pollination success on small farms and honey bee health. In particular, the stress of conventional migratory beekeeping seems to contribute to honey bee losses. This might be a

path of future investigation.

It might be useful to investigate the effect of marketing varietal honey on honey bee health. We suspect that insistence on varietal honey might be overrated since it was possible to win the award for the World's Best Honey (from the Center for Honey Bee Research, 2016 harvest) with honey from a diverse floral landscape.

Information Products

- [Pollination on Small Scale Farms with Rachel Coventry](#) (Multimedia)
- [Pollination Guidelines for Small Farms](#) (Book/Handbook)

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



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