

Title: Managing Native Pollinators for Pennsylvania Orchards

Personnel:

- PI:** Dr. Daniel E. Weber – Penn State Extension
670 Old Harrisburg Road • Suite 204 • Gettysburg, PA 17325
+1 (717) 334-6271 • daniel.weber@psu.edu
- Co-PIs:** Dr. Robyn Underwood – Penn State University
Dr. Margarita López-Urbe – Penn State University
Dr. David Biddinger – Penn State University
- Collaborators:** Donald Seifrit – Penn State Extension

Duration of Project: 1 year

Justification

Objective

The purpose of this proposed work is to develop a two-part workshop on native and introduced pollinator management specifically for the tree fruit industry. The objectives of this project include:

1. Training orchard owners and workers to identify native pollinators.
2. Demonstrating the conditions necessary to maintain healthy populations of native pollinators and honey bees in the orchard while using integrated pest management techniques to control problem insects and diseases.
3. Developing tools to assist orchard owners in the creation and maintenance of native pollinator habitats, including site selection, preparation, appropriate supporting ecosystem establishment.
4. Providing “hands-on” experiences for managing native pollinators and establishing their presence in an orchard.

Extension Advisory Committee Priorities

The proposed research meets the SHAP Extension priority *Entomology/Interdisciplinary: Pollinator Management*.

Narrative

Pollination is a critical ecosystem service that is responsible for the increased quantity, quality, and stability of over 60% of cultivated crop species including pome fruits such as apples and stone fruits such as cherries (Klein et al., 2006). The economic value of pollination represents 9.5% of the total value of the world’s agriculture and it is estimated to be worth at least \$200 billion/year (Gallai, Salles, Settele, & Vaissière, 2009). In Pennsylvania, growers obtain over \$150 million annually from sales of apples, peaches, and cherries, which are completely dependent on bees for pollination. Recently, over half the apple growers and all peach growers now rely completely on fifty or so species of wild pollinators instead of honey bees (M. Park et al., 2015; M. G. Park et al., 2018). Despite the undoubted ecological and economic importance of pollinators as ecosystem service providers, a number of managed and wild pollinator taxa are exhibiting pronounced declines while some crops are being hand-pollinated in parts of the world (Biesmeijer et al., 2006).

Given the great importance of pollinators for crop production and the recent decrease in the number of managed honey bee colonies available for pollination services, the topic of how to maximize pollination services of stone fruit crops is of great importance for the sustainability of agricultural systems in our region. A large amount of recent research has been dedicated to

identifying drivers of bee decline, potential mechanisms to mitigate threats to pollinators and guidelines to manage alternative pollinators and landscapes for wild bees. (See the *Pennsylvania Pollinator Protection Plan*: <http://ento.psu.edu/P4>). The purpose of these pollinator workshops is to bring together scientists, Extension educators, growers, and beekeepers to learn and discuss practical aspects of tree fruit pollination and pollinator management.

Citations

- Biesmeijer, J. C., Roberts, S. P. M., Reemer, M., Ohlemüller, R., Edwards, M., Peeters, T., ... Kunin, W. E. (2006). Parallel Declines in Pollinators and Insect-Pollinated Plants in Britain and the Netherlands. *Science*, *313*(5785), 351–354. <https://doi.org/10.1126/science.1127863>
- Gallai, N., Salles, J.-M., Settele, J., & Vaissière, B. E. (2009). Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics*, *68*(3), 810–821. <https://doi.org/https://doi.org/10.1016/j.ecolecon.2008.06.014>
- Klein, A.-M., Vaissière, B. E., Cane, J. H., Steffan-Dewenter, I., Cunningham, S. A., Kremen, C., & Tscharntke, T. (2006). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B*, *274*(1608), 303–313. <https://doi.org/https://doi.org/10.1098/rspb.2006.3721>
- Park, M., Danforth, B., Losey, J., Agnello, A., Biddinger, D., Rajotte, E., ... Dollar, J. (2015). *Wild Pollinators of Eastern Apple Orchards and How to Conserve Them* (2nd ed.). Cornell University, Penn State University, and The Xerces Society for Invertebrate Conservation. Retrieved from <https://www.northeastipm.org/about-us/publications/ipm-insights/ipm-resource-wild-pollinators-of-eastern-apple-orchards-and-how-to-conserve-them/>
- Park, M. G., Joshi, N. K., Rajotte, E. G., Biddinger, D., Losey, J. E., & Danforth, B. N. (2018). Apple grower pollination practices and perceptions of alternative pollinators in New York and Pennsylvania. *Renewable Agriculture and Food Systems*, 1–14. <https://doi.org/10.1017/S1742170518000145>

Procedures

Methods

This project will be implemented as two separate workshops timed to coincide with developments in the orchard at bloom time and after the season has ended when growers have more flexibility with their schedules.

The first workshop will be held in the spring during peak bloom time (for either stone or pome fruit depending upon the progress of the season) in order to observe pollinators in action within an orchard, and to assist participants in identifying the characteristics and habits of both native pollinators and honey bees actively pollinating trees. This will be a short workshop, currently set for two, or possibly three hours at the most and organized primarily in an “orchard meeting” format.

Prepared specimens will be used to identify the most likely pollinators to be observed in the field, to familiarize participants with each pollinator’s basic appearance and characteristics prior to field observations. This will be followed by a short description of the most common pollinators’ typical behaviors: what they are seeking as they travel among the flowers, what conditions under which they are most active, and where they go upon leaving the orchard.

Following this short classroom session, the orchards at the Fruit Research and Extension Center (FREC), or other suitable location, will be visited to observe pollinators in their natural habitat. The instructors will provide nets and safety equipment to safely capture pollinators for identification and, in the case of honey bees, to closely observe an active hive. While in the orchard, the siting of

pollinator strips – areas of land set aside to support pollinators when the trees are no longer in flower – will be discussed, including a brief discussion of plants suitable for this task.

The second workshop will be interactive (“hands-on”) and will be held at the conclusion of the season. One of the primary features of this workshop will be laboratory experience whereby participants will be trained in how to build, maintain, and clean mason bee nest boxes (“bee houses”) for establishing populations of *Osmia* spp. (mason bees) in their orchards. The nest boxes, additional supplies, and a sufficient number of *Osmia* cocoons to establish a local population will be provided to workshop attendees.

This second workshop will also detail principles discussed at the spring workshop, such as the steps necessary to prepare and provision pollinator strips. It will cover additional topics as well, including: how to avoid stressing native populations during spraying for pests and diseases; sources of environmental stress on native pollinators and how to mitigate them; the effectiveness of native pollinators compared to honey bees and when the use of honey bee hive rental makes the most economic and operational sense; how to analyze expenses associated with managing colonies; and, how to apply for funding from the NRCS to defray the cost of establish these pollinator strips.

Attendees of the second workshop will not need to have attended the first workshop to benefit.

Expected Outcomes

At the conclusion of the first workshop, attendees should be able to:

1. Identify the major native pollinators frequently found in Pennsylvania orchards.
2. Describe the different behaviors of the native pollinators and honey bees with respect to preferred habitats and food sources.
3. Evaluate their own orchards for the siting of pollinator strips to support native pollinators when the orchard is no longer in bloom.
4. Recognize the signature of a healthy honey bee colony, recognize symptoms of a hive in distress, and in the case of the latter, identify resources for treatment.

At the conclusion of the second workshop, attendees should be able to:

1. Identify the major native pollinators and describe their habits and habitats (if not having acquired that skill in the first workshop).
2. Develop a robust integrated pest management plan that protects native pollinators and honey bees.
3. Construct and refurbish nest boxes suitable for *Osmia* mason bees.
4. Safely handle and clean *Osmia* cocoons of parasites and properly store them for release in the spring.
5. Plan the installation of pollinator floral provisioning strips and pollinator hedgerows, including the development of a reasonable timeline, affordable budget, and appropriate list of plant species.
6. Prepare a request for funding from the NRCS to assist in the installation of these strips.
7. Prepare a budget and plan for placement of native bee nest boxes or honey bee hives within an orchard.

An additional outcome of this work will be a collection of reference material suitable for publication on the Extension and FREC web sites. The material will include some simple budgeting worksheets. A poster will also be prepared for the Mid-Atlantic Fruit & Vegetable Convention concerning the essential steps to establishing populations of native pollinators in Pennsylvania orchards. A summary of the workshops and their contents will also be provided at the conclusion of the program in the form of a short paper for the *Pennsylvania Fruit News*.

Conclusion

As healthy managed honey bee colonies decrease in commercial availability, and as wild populations of honey bees and native pollinators decline due to environmental pressures, the need to develop a diversified pollination strategy for orchard crops will be essential to ensure sufficient fruit set to maintain optimal production levels and profitability. The purpose of these workshops is to introduce honey bee and native pollinator management principles to orchard owners, and to provide them with the information, tools, and equipment necessary to develop a robust pollination program for their orchard.

Budget

Hourly Wages	\$ 600	(Program assistant at 40 hours at \$15 per hour.)
Fringe Benefits.....	\$ 48	(7.86% of assistant wages, rounded to next dollar.)
Supplies		
<i>Osmia</i> nest boxes	\$1,125	(25 hives at \$45 per hive.)
Additional box supplies	\$ 125	(25 additional supplies at \$5 per hive.)
Printing and Copying.....	\$ 125	(25 packets at 50 pages per packet at \$0.10 per page.)
Misc. office and field supplies...	\$ 100	
<u>Travel.....</u>	<u>\$ 610</u>	(Speaker/assistant travel at \$0.575 per mile.)
Total	\$ 2733	

A complete budget justification statement describing each category request in additional detail may be obtained from the College of Agricultural Sciences Grants and Contracts Office.

Other Support

No other financial support exists at this time for this project.