GROW WISE.
BEE SMART.

RESEARCH PROGRESS

The Horticultural Research Institute, in collaboration with AmericanHort, continues to directly fund and leverage research to refine science-based guidance on horticultural practices and protecting bee and pollinator health. As part of the broad-based Horticulture Industry Bee & Pollinator Stewardship Initiative that includes industry and consumer outreach and the establishment of industry best practices, the Horticultural Research Institute has directly funded four important research projects. These projects are a continuation of HRI's longstanding commitment to fostering new information relevant to horticultural practices, techniques, and principles.

The involvement of HRI and the horticultural industry in pollinator research is essential toward fulfilling the industry's role in supporting healthy pollinator populations. Horticulture provides the very thing pollinators need to thrive: abundant sources of forage. HRI is hopeful that these and other ongoing projects result in helpful best practices guidance for growers, retailers, and landscape professionals.

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PROJECT ONE SYNOPSIS

Residues of and Rapid Assessment of Toxicity for Neonicotinoid Insecticides in Pollen and Nectar in Model Plant Systems. – Dr. Richard Cowles, Connecticut Agricultural Experiment Station

Significant data gaps related to the concentration of systemic insecticides in nectar and pollen of ornamental plants hamper efforts to assure the public and retail plant sellers that growers' practices are safe to bees and other pollinators. Dr. Cowles aims to conduct pesticide residue analysis in pollen and nectar from treated plants commonly used in the landscape. He expects to further understanding of systemic insecticide uptake and potential interactions with nectar and pollen. In turn, this knowledge will help establish best management guidelines for growing plants and protecting pollinators.

Key Take-Aways To Date:

Residue analyses are still underway, but preliminary data indicate:

- When applied as a foliar spray, dinotefuran, imidacloprid, and thiamethoxam residues declined more rapidly in pollen when compared with drench applications.
- Product rate at the time of application impacts longevity of residue detection. High-labeled rates of each product applied as a drench led to long-term presentation of residues in plants as compared with moderate and low rates.
- Sunflower may or may not be representative of other plants with respect to the dynamics of neonicotinoid movement into pollen.

"Data from additional replicates will be required to state with greater confidence whether the preliminary results are consistent. The bottom line is that the analytical chemistry side of this project is extremely laborious." ~Dr. Cowles

PROJECT TWO SYNOPSIS

Understanding the Opportunities Present for Bees from Commercial Plant Material. – Dr. Victoria Wojcik, The Pollinator Partnership

This project addresses the interactions of bees with landscape plants in order to be better informed on which specific cultivars and varieties bees most frequent. This work will help guide some of the treatment protocols for specific plants and help the industry in marketing particular varieties that are most advantageous for pollinators.

Key Take-Aways To Date:

Based on a survey of the largest wholesale growers in Pennsylvania conducted in 2015, the top 20 commercial ornamental plant stocks were identified. These 20 plants will be planted in two replicates at the State College Campus. In 2016 pollinator preferences exhibited by honeybees, bumblebees, and native bees will be sampled. The impact of the nutritional quality of the pollen and pollinator preferences provided by these flowering plants will be determined. Pollen samples will be evaluated for the ratios of macronutrients and correlated with attraction.

The ultimate goal is to identify additional species and cultivars of flowering plants that will optimally support pollinator populations. Furthermore, it will allow growers to develop production practices for key plant stocks that reduce the exposure of pollinators to potentially harmful pesticides.

PROJECT THREE SYNOPSIS

Best Management Practices for Growing Bee-Friendly Plants in the Greenhouse. –Dr. David Smitley, Michigan State University

Dr. Smitley conducted research aimed at developing scientifically based best management strategies for the production of high quality greenhouse-grown plants that are safe to pollinators after they are purchased and planted.

Key Take-Aways To Date:

Three experiments were conducted during 2014 and 2015 to investigate the impact of imidacloprid residues in flowers following soil drenches or foliar sprays of imidacloprid residues on 7 common annual species, including petunia, verbena, geranium, marigold, portulaca, salvia, and begonia. The studies found systemic uptake and movement of neonicotinoids within plants varied greatly from plant to plant.

- When whole flower parts were analyzed for imidacloprid residue (following a drench application), concentrations varied greatly among the 7 types of annual flowers drenched. For example, residues in petunia were high, while residues in geranium and marigold were nonexistent.

- Bumblebee populations declined faster and more dead bees were recovered after being caged on plants drenched with imidacloprid (with no alternate food source), as compared with untreated plants. Therefore, until more research is conducted, extreme caution should be exercised when drenching imidacloprid on bee attractive plants the spring they are sold.

- Foliar applications of imidacloprid made more than 3 weeks before shipping resulted in very low levels of imidacloprid in a dislodgeable residue study. These residues are unlikely to have an impact on pollinators.

- More work is needed to better understand the relationships between application rates, plant types, and systemic movement of pesticides into pollen and nectar. The amount of imidacloprid found in pollen and nectar may be much less than the amount in flower sepals and petals and needs to be investigated for annual and perennial flower types.

"Many of the most popular annual flowers are not frequently visited by bees, and therefore production practices used on these flowers will have little impact on bees in the yard and garden." ~Dr. Smitley

PROJECT FOUR SYNOPSIS

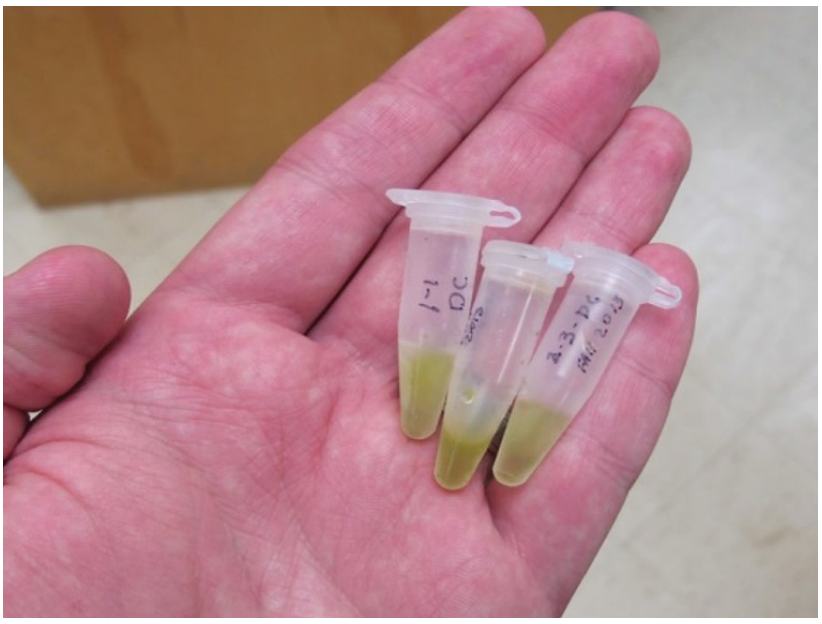
Assessing Bee Attractiveness of Woody Landscape Plants and Mitigating Potential Bee Hazard from Neonicotinoid Insecticides. – Dr. Dan Potter (Professor) and Bernadette Mach (Ph.D. Student), University of Kentucky

This project will support planting recommendations for landscapes that sustain bees throughout the growing season, identify plants that warrant particular caution when using systemic insecticides, and highlight plants whose floral characteristics reduce the potential for bees to be impacted by systemic insecticides. In addition, Dr. Potter and Ms. Mach aim to identify best management practices by which producers and landscape managers can protect plants from pests while mitigating the risk to bees. Residue analysis is another key component of these studies, and nectar analyses of clethra, hawthorn, and holly treated in autumn, pre-bloom, or post-bloom still are underway.

Key Take-Aways To Date:

To date, Potter and Mach have sampled over 70 types of woody ornamentals in more than 300 sites over three growing seasons, identified 16,000 bees, and amassed a treasure trove of information regarding plant attractiveness:

- Different woody ornamentals attract unique bee assemblages; i.e., relatively more honey bees, bumble bees, or smaller native bees depending on bloom time, flower shape, and other factors.
- Native and non-native plants can both be good for bee-friendly landscapes.
- Most bees collected in urban landscapes are polylectic types, that is, they use a variety of pollen/nectar sources throughout the growing season.
- Many of the best woody ornamental bee-attractive plants have no key pests and are rarely, if ever, treated with insecticides.
- Some of the landscape plants most likely to be treated with insecticides (azaleas, boxwoods, hybrid tea roses) attract few or no bees.



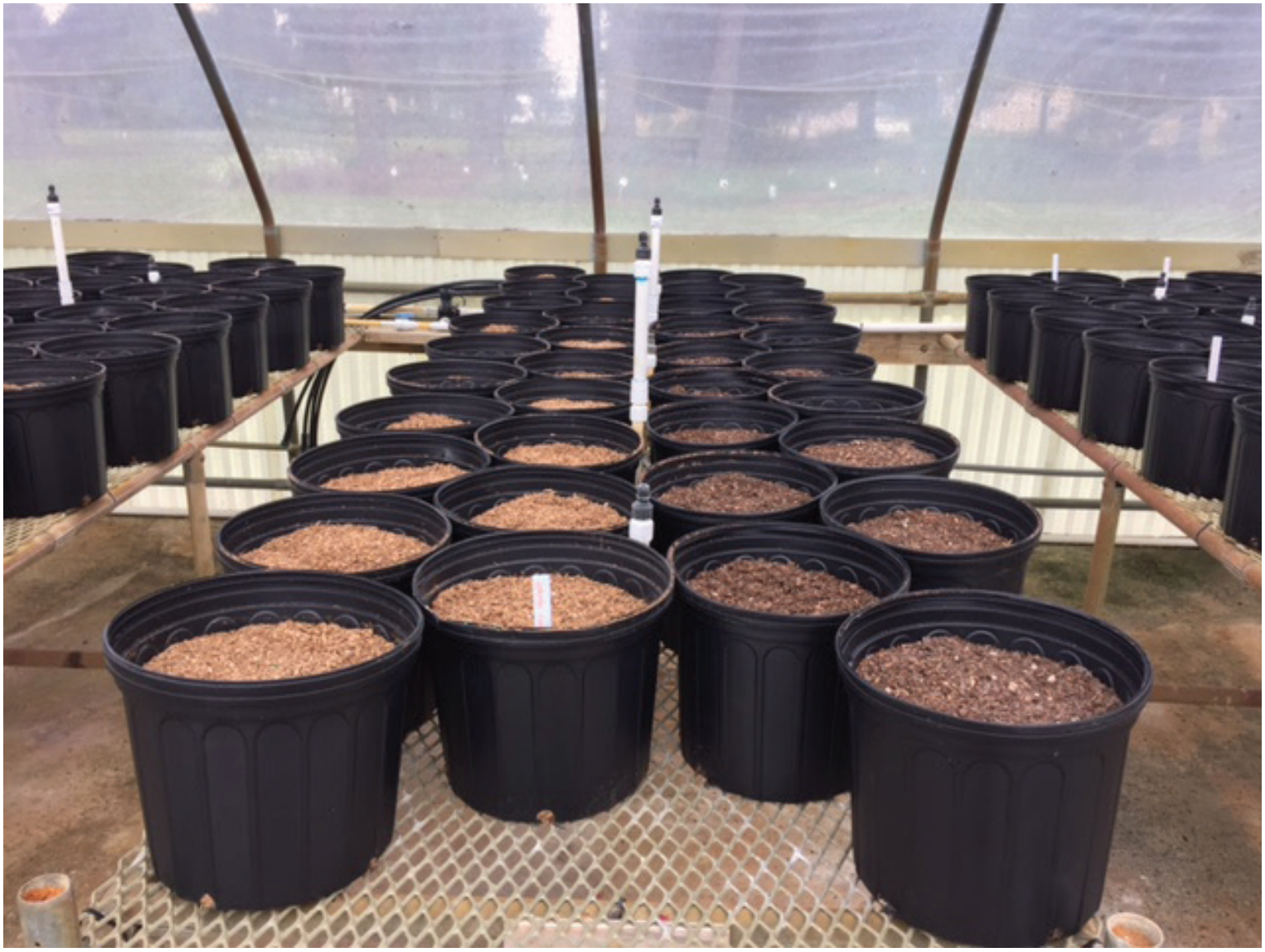
- Most woody ornamentals bloom for less than 2 weeks and are attractive to bees only part of that time. Therefore, pollinator-friendly landscapes should contain a mix of early, mid- and late-blooming trees and shrubs to help sustain bees through the growing season.

"For our gigantic woody plant bee survey, tracking the bloom times and driving to sample sites scattered around the Ohio Valley region is like a landscape-level game of 'whack-a-mole – bees on it today but wait a few days and it is past peak with few or no bees on it." ~Dr. Potter

Our Top Woody Ornamentals for Honeybees	
Common Name	Scientific Name
Cornelian cherry	*Cornus mas*
Higan cherry	*Prunus subhirtella* 'Autumnalis'
Foster's holly	*Ilex* x *attenuata*
American yellowwood	*Cladrastis kentukea*
Common winterberry	*Ilex verticillata*
Linden	*Tilia cordata, americana*
Golden raintree	*Koelreuteria reticulata*
St. John's Wort	*Hypericum frondosum*
Bee bee tree	*Tetradium danieli*
Winged sumac	*Rhus copallinum*

Our Top Woody Ornamentals for Bumblebees	
Common Name	Scientific Name
Red horsechestnut	*Aesculus* x *carnea*
American yellowwood	*Cladrastis kentukea*
False indigo	*Amorpha fruticosa*
Buttonbush	*Cephalanthus occidentalis*
Sweetspire	*Itea virginica*
Golden raintree	*Koelreuteria reticulata*
St. John's Wort	*Hypericum frondosum*
Clethra	*Clethra alnifolia*
Glossy abelia	*Abelia* x *grandiflora*
Seven-son flower	*Heptacodium miconioides*

1. Collected twigs with flowers.
2. Estimated 300 person-hours to extract enough nectar and pollen from 30 plantss
3. Hawthorn nectar, 200-300 flowers extracted per tube.



RELATED RESEARCH SYNOPSIS

Fate of Substrate-applied Neonicotinoids in Container Substrates for Commercial Nursery Crop Production. –Dr. John Adamczyk, USDA-ARS; Glenn Fain, Auburn; Anthony Witcher, Tennessee State University; Eugene Blythe, Mississippi State University; and Yan Chen, Louisiana State University

Through HRI's general grants program, a collaborative project was funded to address imidacloprid accumulation in greenhouse and nursery crops during production.

Key Take-Aways To Date:

A controlled greenhouse study compared absorption of imidacloprid by chrysanthemum and roses when grown in either whole pine tree-based or pine bark substrate.

- Plants grown in whole pine tree substrate had greater imidacloprid concentrations compared with plants grown in pine bark-based substrates.
- The overall findings showed that imidacloprid can bind more readily to soil particles high in organic matter, such as pine bark, resulting in reduced absorption by plants, and therefore, potentially reduced efficacy.