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What is going on with pollinators, what role do pesticides play, and why should the green industries care?

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What is the problem? Pollinator health has recently been the focus of popular media, environmentalists, apiary specialists, and scientists. In 2006 after winter periods unusually high honey bee colony losses were reported by bee keepers in the United States, and in other countries over the last decade. This syndrome is what is now known as Colony Collapse Disorder. In addition to issues with honey bees, attention to bumble bees and other bees has raised concerns of declines in the number of species and abundance of these pollinators.

What is causing the problem? Numerous scientific studies, both laboratory and to a lesser extent field studies, have been conducted to identify causal factors of changes in honey bee and bumble bee populations. Causal factors likely vary between honey bees and bumble bees. In recent reviews of the data, scientists have identified the interaction of multiple primary factors that affect honey bee health that include parasites (*Varroa* mites), pathogens (fungi, viruses), nutrition, and colony maintenance. To a lesser extent, pesticides may interact with the above factors resulting in sublethal effects that may affect colony health. Data suggest that pesticides in general, and neonicotinoids in particular, are not primary factors in colony collapse disorder. For bumble bees, data suggest that pesticides may play a role, but there is still a need for more field level studies. There are many "issues" associated with the interpretation of the data from research studies. For example, laboratory studies sometimes evaluate levels of pesticides that are greater than bees are likely exposed to under field conditions. In addition, bee biology and behavior can influence the actual levels of pesticide exposure that bee or bee colonies encounter. This questions the accuracy of inferences from lab to field situations. Because of the variable results from different lab and field studies, interpretation can be quite variable.

What about neonicotinoid insecticides? Some groups have focused on the class of insecticides called neonicotinoids, citing them as a major cause of the problem with bee health. Regulations restricting the use of neonicotinoid insecticides in Europe have been implemented, and are under discussion in Canada. In the U.S. the EPA has accelerated reviews of neonicotinoid insecticides and mandated the addition of a "bee advisory box" on all products containing neonicotinoids. There is pressure from various groups to remove or further restrict the use of neonicotinoids, especially from ornamental and turfgrass systems.

What are neonicotinoid insecticides and their potential risks? Neonicotinoid insecticides are insect neurotoxicants. In the green industries these include imidacloprid, thiamethoxam, clothianidan, acetamiprid, and dinotefuran. They have many desirable features such as broad-spectrum activity, low application rates, low mammalian toxicity, systemic movement upward in plants, and multiple application methods (soil drenches, foliar sprays, or injected into plants). They have proved very effective and generally safe in controlling many sucking, plant boring, and turf feeding insects. Their distribution throughout the plant and long residual activity has contributed to their effectiveness in controlling plant damaging insects. Because of these benefits neonicotinoids are widely used in the

green industries (and agriculture) for managing many potential pest insects. Neonicotinoids are especially useful for tree conservation and invasive insect species management. For invasive species such as emerald ash borer, Asian longhorned borer, and hemlock wooly adelgid, neonicotinoids are one of the only effective tools towards preventing massive loss of trees in our urban landscapes. Neonicotinoids have been effective in controlling numerous landscape and turf pests.

These benefits also suggest they may result in greater risk to pollinators. Statements have been made that higher rates of neonicotinoids are applied in ornamental systems and that this increases risk to pollinators. A concern is when neonicotinoids are sprayed on open flowers of insect pollinated plants, or with some plant species they have the potential to move systemically into pollen, nectar, and guttation fluids, posing particular concern for exposure to pollinators. There is still a lot we do not know about the effects of pesticides, including neonicotinoids, on pollinators and other beneficial insects, and their movement into and residual activity in various plant parts. Therefore, more research is necessary before it can be said if pesticide residues may or may not affect pollinator health.

What course of action and factors should be considered when managing potential pests in ornamental and turf systems? First, neonicotinoid insecticides are in the spot light as a major factor affecting bee health, regardless of what the data suggests. In addition, complete information is still lacking on their impacts on pollinators. Second, the green industries tends to rely on products that contain neonicotinoids for managing a wide array of pests. In some situations these are the best or only choices, for other pests there are alternatives management tactics that could be used. Third, there is the potential for EPA to remove or greatly restrict the use of neonicotinoid insecticides, especially use in ornamental and turf systems. Therefore, it would be wise to reduce the use of and reliance on neonicotinoid insecticides in your business and to be sure you and your employees are aware of potential risks to pollinators and non-targets in general of the insecticides they are applying. Many other insecticides are also toxic to pollinators and non-targets. Be sure to READ THE LABEL thoroughly and follow the directions.

Consider the following when making plant and pest management decisions. Choose non-chemical management tactics whenever possible. Select pesticides that have low impact and risk to pollinators. Only use neonicotinoids when other effective products do not exist (ex. reduce reliance on neonicotinoids). Avoid prophylactic use of neonicotinoids (ex. do not make applications unless you actually have an insect at levels likely to cause damage to the plant or turf). Know which plants are wind-pollinated vs. insect-pollinated. Do not apply foliar sprays to insect pollinated plants until after petal drop. Similarly try to avoid trunk and soil injection of neonicotinoids on insect pollinated plants (not enough is known on residual levels of neonicotinoids in the nectar and pollen over time to assess risk).

The University of Maryland Extension will continue to provide information on all alternative control materials and tactics throughout the growing season. We will be posting relevant publications of research or reviews of research on the UME IPMNet web site (**extension.umd.edu/ipm**) for your information.

April 11, 2014

Information and comments provided in this article are based on scientific information currently available to the best of the author's knowledge.