

Imidacloprid Residue Analysis of Honeybee Materials in 2007 Orem City Japanese beetle Eradication

Utah Department of Agriculture and Food

Introduction

The Japanese beetle, *Popillia japonica*, was introduced in the USA almost 100 years ago. Since then, it has become an economically damaging pest and continues to spread with nursery stock and turf. Even under the best of circumstances with diligent inspections and border surveillance, these materials are moved extensively and present a constant risk. The Japanese beetle feeds on over 300 plant species, many of which are in Utah. It also tolerates our climate and could readily establish here, to the detriment of a \$124 million nursery and floriculture industry and Utah's quality of life. Utah Department of Agriculture and Food (UDAF) has placed detection traps for this pest for 8 years, to allow swift response to any introductions of Japanese Beetle. When an infestation was discovered in Orem in July 2006, UDAF devised an eradication program to prevent Japanese Beetle from establishing in Utah.

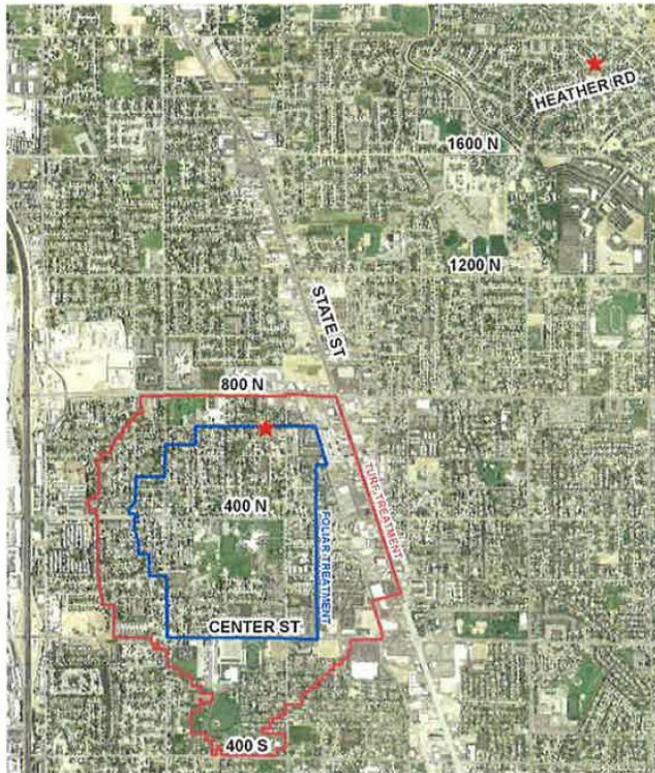
Although there are biocontrols and biorational treatments for Japanese Beetles, these are density dependent and not easy to use in Utah's climate. The most effective tools available to eradicate this pest in Orem are effective traps with pheromone lures, and chemical treatments to kill the grubs in the ground and adults on the foliage. The active ingredient used to kill grubs, imidacloprid, was applied to turf at the labeled rate (0.39lbs AI per acre). This chemical is relatively non-toxic to vertebrates, but it is very controversial in apiculture. Its early use in France as a seed coat coincided with unusually high bee losses in the mid to late 1990's. Since then researchers have studied the impact of this chemical on the bees, and the results are conflicting. Because of this debate, our choice to use this chemical in Orem prompted meetings with beekeepers, where we recommended the safest action—that they move their colonies if possible. In addition, we cooperated with beekeepers that kept bees inside and outside the treatment zone to count bee kill at the entrance, and collect samples of bees, honey and pollen before and after treatments. These samples were analyzed by an exceptionally sensitive chemical technique, High Performance Liquid Chromatography Mass Spectrometry (HPLC-MS), in a lab that had already developed this protocol for honeybee materials. The HPLC-MS was performed in the USDA National Science Laboratory in Gastonia, NC. (Protocol attached)

Results

Samples were analyzed from two locations, one within the treatment zone and one outside the treatment zone (see map below). There were no differences in the number of dead bees collected in front of the hives before and during the Japanese beetle treatment. Each sample was tested for imidacloprid and two known products it degrades to, imidacloprid 5-hydroxy and imidacloprid olefin. ND indicates that the sample had non detectable levels of imidacloprid or its metabolites. Only one detectable residue was found, imidicloprid in honey from colonies within the spray block at the end of the season, at a level of 9 parts per billion. The results are summarized below.

Sample Material	Inside Trt Zone		Outside Trt Zone	
	Before trt	After trt	Before trt	After trt
Honey	ND	9ppb	ND	ND
Pollen	ND	ND		
Bees	ND	ND		

The EPA determines tolerances for pesticide residues in foods. The levels of imidacloprid found in the honey taken from within the treatment zone are far below the EPA tolerance for all food listed. Honey is not listed, but as an example the tolerance in grains and nuts is 50ppb, which is much higher than the concentration we detected in honey. Furthermore, most studies concur that there is no detectable imidacloprid effect on honeybees at concentrations below 20 ppb.



This map shows the location of both apiaries sampled (marked by red stars). One apiary is within the treatment zone, and one is approximately 2 miles from the treatment boundary.

Future Studies

This monitoring project will continue with the same methods annually until the Japanese beetle project is completed. Special attention will be paid to determine if the residues persist and accumulate.

Summary

Utah Department of Agriculture and Food recognizes the need to protect and serve the beekeeping industry and preserve beneficial insects at large. The impact of imidacloprid on honeybee health is not well understood. With the selection of this chemical treatment for Japanese Beetle larvae, UDAF found cooperators and devised methods to monitor any bee death or chemical residues left in bee colonies. Two colonies within the treatment area and two outside the treatment were sampled before and after the JB eradication project. No residue was detected in honey from the colonies outside the treatment zone. Within the treatment zone, no residues were found before treatment in pollen, honey or dead bees. At the end of the season (after JB treatment) honey from these colonies was found to contain 9ppb imidacloprid. This concentration is far below that tolerated by the EPA in food commodities and lower than the concentration reported to affect honeybee mortality or behavior. UDAF will continue to work with these beekeepers and sample hive products annually until the project is complete.