3.4 Thiamethoxam Honey Bee Large Scale Colony Feeding Study – Design and Interpretation

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Abstract

Colony feeding studies were originally developed to directly assess the insect growth regulating properties of insecticides and designed to determine mode of action rather than effect levels. More recently there has been regulatory interest in conducting colony feeding studies to determine the pesticide level in nectar substitute (sucrose solution) which leads to colony-level effects, thereby allowing for comparison with residue concentrations detected in pollen and nectar from treated crops. In 2016 a colony feeding study was conducted with thiamethoxam in central North Carolina, USA with the aim of providing a robust colony-level endpoint for comparison with residues in pollen and nectar detected following applications in bee-attractive crops. Honey bee (*Apis mellifera ligustica*) colonies were fed, directly within the hive, thiamethoxam spiked sucrose solution twice weekly for a six-week period from early July to mid-August during a nectar dearth period in an area with limited row-crop agriculture. The following concentrations were provided at each application; 12.5, 25, 37.5, 50 or 100 ppb thiamethoxam. The study consisted of twelve apiaries containing one treatment colony for each concentration, two control colonies and one monitoring colony which was used to determine what the bees were foraging on in the landscape and if exposed to any other agrochemicals via pollen identification and pollen and nectar residue analysis, respectively. Colony Condition Assessments (CCAs) were conducted prior to the start of exposure in July, through late October, and after overwintering the following year to observe the overall colony performance. In addition, samples of bee pollen and nectar/honey were collected at intervals before, during and after the exposure phase for analysis of thiamethoxam and its major metabolite CGA322704 (clothianidin). The data showed statistically significant effects at the 100 ppb treatment level in several colony parameters, therefore the Lowest Observed Adverse Effect Level (LOAEL) is 100 ppb. At 50 ppb, with the exception of two time points for pollen stores, all colony parameters measured over the course of the study were similar to the controls including over-wintering survival, therefore confirming the No Observed Adverse Effect Level (NOAEL) is 50 ppb. This colony NOAEL of 50 ppb provides the basis by which to evaluate the potential risk of thiamethoxam residues detected in pollen and nectar following treatment of bee attractive crops. It also provides additional support for the lack of effects reported in field studies following exposure of colonies to levels of thiamethoxam in pollen and nectar of seed treated crops that are an order of magnitude lower than the no effect level observed in this study.