Investigation of the Impact of Pesticides and Spray Adjuvants on Bee Health and Development

Project Leaders: Diana Cox-Foster
USDA-ARS-PWA Pollinating Insect Research Unit, Old Main Hill UMC 5310, USU- BNR 261, Logan UT 84322
(435) 797-0530, Diana.Cox-Foster@ars.usda.gov

PROJECT SUMMARY

Objectives for current year:

1. Confirm the impact of the fungicides/pesticide combination, organosilicone adjuvants, and combination on bee survival and reproduction
2. Evaluate the impact of fungicides and organosilicones on overall pathology of bees and correlate with the colony level impacts (brood loss, queen impacts, etc.)

Background and Discussion:

Success in almonds depends upon pollination. For honey bees, four factors interact to cause losses: varroa parasitization, pathogens, lack of good nutrition (pollen availability) and pesticide exposure. Some of the factors that may be common to many crops are fungicides and adjuvants. In pollen collections, fungicides rank in the top pesticides detected in incoming pollen; besides these compounds, adjuvants may be an issue. The amount of organosilicones (OSS) applied to almonds was approximately 10% the poundage of all active ingredients applied as reported in the Summary of Pesticide Use Report Data by the California Department of Pesticide Regulation for 2015. Added research is needed to understand the impacts of pesticides on bee behavior, health, and development when fed to colonies. As well, OSS has been found to interact with a bee virus to cause higher larval mortality.

In this research, we asked about the impacts of a fungicide/insecticide mixture of Propiconazole (Tilt) at 150 ppb a.i. and chlorantraniliprole (Altacor) at 3 ppm a.i. and the commonly used adjuvant organosilicone, at 40 ppb and 40 ppm. Recommended use of OSS can range from 300 ppm to 5000 ppm in a tank mix; it is unknown what amounts of OSS bees encounter. The four treatments consisted of: 1) untreated control; 2) fungicide/insecticide-treated [F/I]; 3) organosilicone [OSS]; and 4) fungicide/insecticide/ organosilicone-treated [ALL]. The pesticides were delivered to micro colonies using UltraBee pollen substitute (Mann Lake); we monitored the behavior of foragers and brood development and will determine pathogen levels (with focus on viruses). Micro-colonies were used to create colonies with similar pathogen loads. In order to test the “worst case scenario”, our assumption was that any impacts on behavior, health, and development would occur in the micro colonies, since they lacked the overall resilience of the large workforce of normal colonies. Colonies were begun with sister queens and the same number of workers; but the workers reasserted themselves amongst the hives.

Both starting colony size and treatment had impacts on colony survival. The smallest colonies had the greatest mortality overall and the mortality in the F/I and OSS tended to be higher and these colonies did not grow as fast as the control or the ALL treatments. Among the treatments, marked bees from F/I and OSS were more apt to be found in other colonies besides their own following consumption of the treatments. Swarming/ absconding occurred more often in the treated colonies versus the controls; all bees left the colonies (queens were clipped and marked, so the colonies were found nearby). Behavior was also altered. Pathogen analyses are determining how the infection levels were impacted. Colony survival was followed over the winter; in early spring, two control colonies and one OSS colony were alive but died before the first flowers. All colonies had honey stores remaining.

Impacts on adults and their pathogens by OSS at different concentrations was also tested by feeding OSS for 10 days. Minimal mortality was observed with10 ppm of OSS. Research by Mullin and others has shown mortality with 100 ppm.

Project Cooperators and Personnel: Ellen Klinger, USDA-ARS-PWA PIRU; Craig Huntzinger, USDA-ARS-PWA PIRU

For More Details, Visit

- Poster location 118, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- 2016 – 201r7 Annual Reports (16-POLL19-Cox-Foster) on the web at Almonds.com/ResearchDatabase
- Related project: 17-POLL17-R. Johnson