MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 59-2014 (YEAR 2)
2014 FINAL REPORT

TITLE: Bee Project: Assessing the Impact of Neonicotinoid Seed Treatments on Pollinators

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Background: There is an increasing effort by environmental activists and some bee keepers to ban or severely limit the use of insecticides (particularly the neonicotinoid class) in row crops because it is thought that honey bee exposure to these materials limits bees' ability to ward off disease etc. Thus, these groups consider these insecticides to be a contributing factor to colony collapse disorder. This project is designed to provide a balanced, unbiased approach to verify or dispute these claims in Midsouth cropping systems.

Objective One: Quantify the number of honey bees visiting agronomic crops in MS

Approach: A total of 82 fields were sampled in MS, AR, and TN for the presence of foraging honey bees at 3 times of day in soybeans, corn, and cotton. There were a total of 18 soybean, 36 Cotton, and 28 Corn fields sampled.

Results: Soybeans had significantly more foraging honeybees than either cotton or corn. During the mid-day period, bees were significantly more active than in morning or evening. Evening period is defined as three hours before sunset, and this period had significantly fewer honeybees foraging than did any other period. Very few bees were observed in corn; however, those that were found were more active in the morning period. Soybeans followed the normal trend in the literature for other host crops, with mid-day being the most active period. There was no difference in where bees were located in the field relative to field edge, and only flowering crops had bees present.

(See appendix for detailed information)

Objective Two: Determine the impact of low level background residues of neonicotinoids in the soil on uptake in wildflowers that bees are foraging on.

Activities: This objective is being conducted as part of another ongoing project due to time constraints.

Objective Three: Determine neonicotinoid levels in soybeans and corn from emergence through maturity treated with neonicotinoid seed treatments.

Approach: Soybeans, corn, and cotton were planted in replicated plots and were either untreated or treated with thiamethoxam or clothianidin seed treatments. Tissue samples were collected at VC, V2, V4, and R1 and analyzed for the presence of neonicotinoid insecticides. Soil samples were collected at VC and R1.

Results (Soybeans). Neonicotinoids detected in soybean leaf tissue almost completely diminished before entering reproductive growth. Leaf tissue collected from CruiserMaxx®-treated plots contained 2.16±0.82 ppb of thiamethoxam at the final sampling stage, which was 99.94% less than the concentration of thiamethoxam detected at VC. When Poncho®/VOTiVO®-treated soybean plants reached R1, leaf tissue contained no concentrations of clothianidin. Stewart et al. (2014) found little to no neonicotinoid compounds in soybean flowers in the Midsouth. With only small concentrations of thiamethoxam being found in soybean leaf tissue from CrusiserMaxx-treated soybean plants, and no clothianidin being detected in leaf tissue from Poncho®/VOTiVO®-treated soybean plants when sampled at R1, findings from this study suggest similar results.

Neonicotinoid compounds were found in soybean leaf tissue from untreated plots. Soil from CruiserMaxx®- and Poncho®/VOTiVO®-treated plots at the last sampled growth stage contained levels of neonicotinoids from the seed treatment as well as other compounds not used to treat the seeds planted in those specific plots. Neonicotinoid compounds not used in specific plots were also detected in soil from those plots. Contamination most likely resulted from previous neonicotinoid seed treatment use in previous growing seasons. Levels of neonicotinoids in the soil could be absorbed into neighboring flowering vegetation and potentially made available to foraging honey bees in the area.

(See appendix for detailed information)

Objective Four: Evaluate the impact of 3 planter lubricants (Talc, Graphite, and EXP) on ability to become contaminated with neonicotinoid from treated seed and drift downwind to wildflowers around field edges where bees are foraging.

Approach: Studies were conducted in Mississippi, Arkansas, and Tennessee to determine the rate at which neonicotinoid seed treatments drift with various seed lubrication products during planting. Each test consisted of a pneumatic air planter planting seed with the wind blowing perpendicular to the planter. Flats of Marigolds were placed downwind of the planting strip at distances of 0, 5, 20, 50, and 100 meters. The experiment was replicated 5 times by days. After each test, the Marigolds heads were clipped. Samples were sent to the National Science Laboratory in Gastonia, North Carolina to determine if dust or seed lubricant containing neonicotinoid insecticide had drifted onto the Marigold flowers.

Results: Regardless of seed lubricant used in the test, positive detections were found downwind out to 100 meters from the planter. This indicates that neonic see lubricant can drift at least 100 meters but likely further. The experimental seed lubricant by Bayer CropScience only numerically reduced the number of positive detections on flowers downwind compared to talc or graphite in this study. Concentrations (ppb) at each location downwind were variable and rate of seed treatment did not matter. Based on these results, it is highly plausible that neonic seed treatments can come off the seed, mix with planter lubricant, and be blown out of pneumatic planters and coat wildflowers around fields.

(See appendix for detailed information)

Non graduate student portion of study

Objective: **Analyze samples already taken by the Mid-South Entomology Working Group through mass spectrometer analyses for concentrations of neonicotinoids.**

Activities: 2014, Published data in Journal of Environmental Science & Technology
http://pubs.acs.org/doi/abs/10.1021/es501657w

APPENDIX

The details of the conduct of and results from this study are contained in a Master of Science Thesis entitled "Factors influencing honey bee abundance across agricultural landscapes in the Midsouthern US" by Daniel A. Whalen. Click here to access the thesis.