INVESTIGATING INSECTICIDE AND FUNGICIDE RESIDUES OVER TIME IN COTTON AND SOYBEAN

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Abstract

The impact of pesticides on the pollinator community has become an increasingly hot topic in crop production. Insecticides and neonicotinoids in particular have received the most attention, but there are also concerns about the potential negative effects of fungicides on pollinator health. Consequently, the persistence of pesticides following a foliar application is of particular interest when a crop is flowering. A study was conducted on the West Tennessee Research and Education Center in Jackson, TN. Two replicates of cotton and a group IV soybean, eight rows each and 100 ft long, were planted. In both cotton and soybean, we applied a tank mix (rate/acre) that included Orthene 97 (1.0 lb), Admire Pro (1.7 oz), Besiege (10 oz), Priaxor (4 oz), and Tilt (4 oz) to the center four rows of each plot with a MudMaster at 9.4 GPA at 40 psi using flat fan 80015 nozzles. Thus, this tank mix included the following active ingredients: acephate, imidacloprid, lambda-cyhalothrin, chlorantraniliprole, fluxapyroxad, pyraclostrobin, and propiconazole. The application was made when soybean reached the R2 growth stage (July 23, 2019) and about seven days after cotton began blooming (July 29, 2019). Samples to assess pesticide residue levels were collected from the center two rows of each plot and included 20 cotton leaves from the third node below the terminal, the anthers from 25 white cotton flowers, and 75 whole soybean flowers. Samples were taken pre-application and 1, 24, 72, 144, and 216 hours (h) after application. After every sampling, samples were weighed and stored in -80˚C freezer until sampling was complete. Samples were then shipped to the USDA AMS National Science Lab (Gastonia, NC) where liquid chromatography coupled with tandem mass spectrometry detection tests were ran to detect residual active ingredients of tank mix applied at the separate intervals of sample times.

In general, insecticide residues degraded more quickly than fungicide residues, which degraded more linearly. Depending on active ingredient, initial insecticide residues at 1 h after application 36-121 times higher on cotton leaves than on cotton anthers and 16-35 times higher than on soybean flowers at 1 h after application. Except for chlorantraniliprole, insecticide residues on cotton leaves decreased by more than 80% by 24 h after application and continued to decline thereafter (Fig 1.). Pesticide residues on soybean flowers, although low compared with cotton leaves, degraded more slowly over time (Fig 2.). Residues found on cotton anthers decreased very quickly (Fig 3). This was expected because only anthers in flowers that were open at the time of application would have been directly exposed to pesticides. Cotton anthers collected after the day of application should theoretically only be exposed through systemic movement pesticides. Generally, these data show a rapid decrease in pesticide residues and particularly insecticides within 24 h of application. It also suggests systemic movement of pesticides to cotton anthers did not result in high residues, probably because plant biomass greatly reduces the concentration of pesticides within the plant. This has obvious implications on both pollinator safety and residual control of target pests.

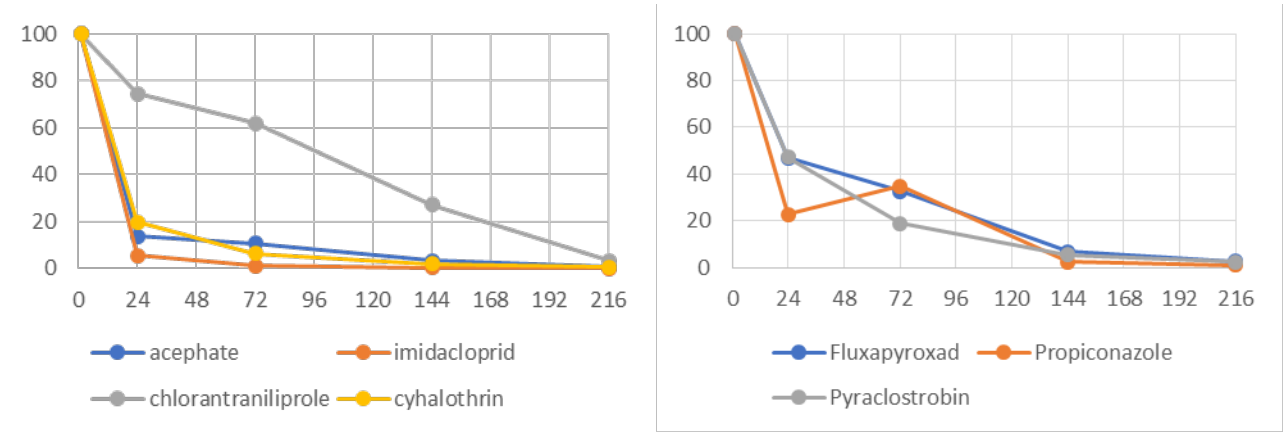

Figure 1: Percent insecticide (left) and fungicide (right) residues on cotton leaves at different times (hours) after a foliar application to blooming cotton.

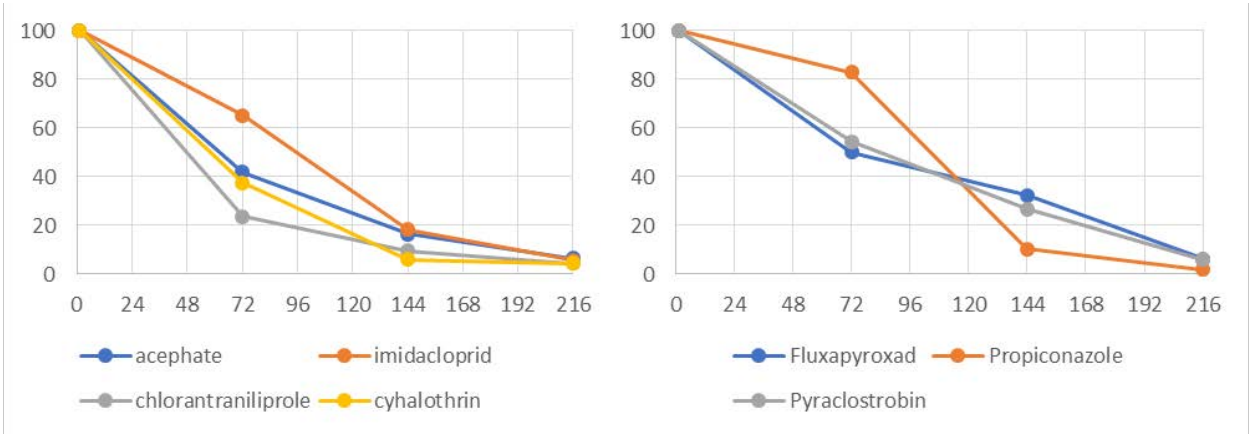

Figure 2: Percent insecticide (left) and fungicide (right) residues on soybean flowers at different times (hours) after a foliar application.

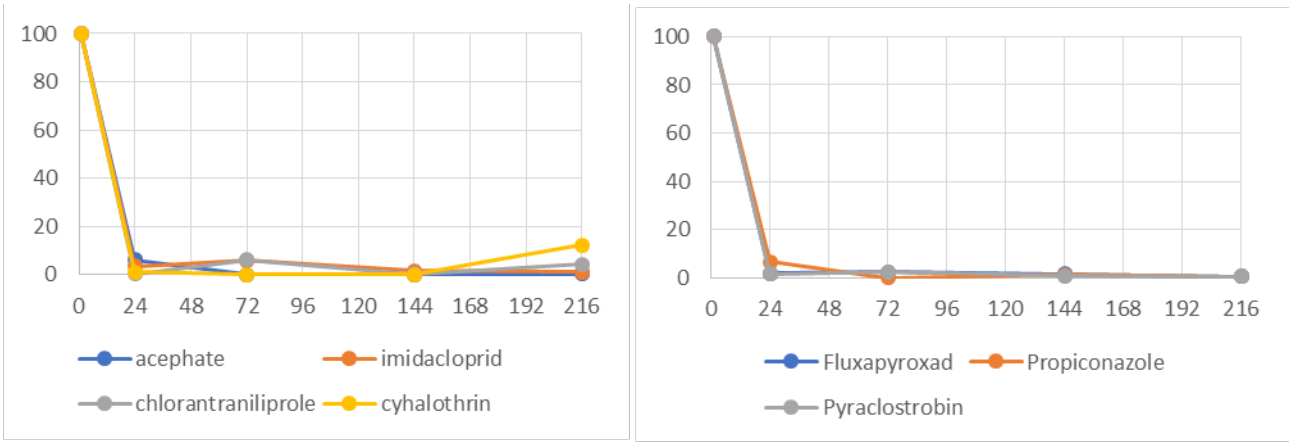

Figure 3: Percent insecticide (left) and fungicide (right) residues on cotton anthers at different times (hours) after a foliar application.