Progress Report for CDPR
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There are two priorities to our research project. The first involves runoff from a concrete wall that we constructed to measure specific parameters such as pesticide type and effect of band width on runoff. Our second priority is the measurement of runoff down driveways of individual homes after application of different pesticides and with different protocols. I will discuss both priorities below. Applications to the wall were done with a backpack sprayer with a 4-way adjustable nozzle.

A. Runoff from a concrete wall

Fig. 1 shows the wall that we had constructed on campus. Each side of the wall has 12 segments from which we can collect water samples (Fig. 2) after specific treatments. Artificial rainfall is provided by a sprinkler system directed at the wall and pad. A 1 liter water sample is collected for insecticide analysis from each wall segment. Before this season's applications both sides of the wall were scrubbed with detergent and thoroughly hosed down. The day after cleaning the wall we turned on the water sprinklers and collected water samples for analysis. For the East side of the wall we found the bifenthrin concentration to be 11.0 ± 1.6 ppt (mean ± SE). On the West side of the wall the bifenthrin concentration was 17.6 ± 2.6 ppt (mean ± SE). As shown below, these baseline figures are insignificant compared to the post-treatment runoff.

This season we treated both East and West sides of the wall with bifenthrin to look at the effect of different band widths on its runoff. For both sides we chose three different bandwidths to apply to the wall and contiguous pad. We used a wide band application of bifenthrin (2 ft up x 3 ft out from the wall), a narrower band (1 ft up x 1 ft out), and a pin stream application (2 in up x 2 in out). Each of the 3 treatments had 4 replicates on each side of the wall. On each side of the wall, a band width treatment was randomly assigned to each segment. The 2 sides of the wall were treated approximately 2 weeks apart.

On the East side of the wall the bifenthrin was applied so as to keep constant the label rate of application per unit area for each of the 3 treatments. This criterion means that the wide band would have the greatest total amount of AI applied per segment because it covers the largest area of the 3 treatments. The pin stream band would have the smallest total amount of AI applied because it covered the smallest area, and the 1 x 1 ft band would be intermediate in total AI applied. We kept the label rate per unit area constant by varying the spray time. Since the pin stream band is the most concentrated band, while the wide band is a fine spray, the pin stream had the shortest spray time, while the wide band had the longest spray time. Each band receive 0.002-0.003 g of AI per sq. ft

On the West side of the wall the bifenthrin was applied so as to keep constant the total amount of AI applied per segment. To keep the AI constant for each segment we varied both the time of the spray application and the concentration of the bifenthrin solution. The wide band had the lowest concentration of the bifenthrin with the longest spray time. The pin stream application had the highest concentration with the shortest spray time. Each band received 0.03402 g of bifenthrin.

In order to do these calculations we measured first the output of the applicator tip at its different band width settings. We found that the output volume per unit time of the different band widths was almost identical. Therefore, an applicator walking at a uniform pace would apply the same amount of AI per

linear foot of a house perimeter, regardless of the band width. The West side of the wall may be a test of this condition where equal amounts of AI are applied to each wall segment.

Results

Fig. 3A shows bifenthrin runoff 1 day post-treatment for the East side of the wall where the label rate per unit area was kept constant. Mean runoff for all treatments varied from 67,000 ppt (2 x 3 ft band) to 151,000 ppt (pin stream band). However, with the N=4, there was no significant difference in the runoff from the 3 treatments ($P > 0.05$, ANOVA). Figure 3B shows runoff from the West side of the wall where the total amount of AI was kept constant for each wall segment. In this case, the pin stream runoff was the lowest at 82,000 ppt and the wide band was the highest at 323,000 ppt. On the West side the pin stream runoff was significantly lower than the other two treatments ($P < 0.05$, Tukey HSD test).

The non-significant difference on the East side of the wall is counterintuitive, as we might expect the wall segment receiving the highest total amount of AI to show the highest runoff. However, although there was no significant difference between the treatments, the wide band application of 2 ft x 3 ft had the lowest runoff. On the other hand, the pin stream treatment received the lowest total amount of AI but was slightly higher than the other two treatments in its runoff.

As mentioned above, during routine spray treatments by Pest Management Professionals, the applicator walks around the house at a constant pace. Our preliminary trials showed that varying the band width did not change the total amount of AI applied per linear foot. The treatments on the West side of the wall mirror these procedures by having equal amounts of AI applied per segment. Under these conditions we found a significantly lower runoff of the bifenthrin when using the pin stream application. However, we have not yet taken into account the relative inputs of the painted wall vs. the unpainted pad adjacent to the wall. The bifenthrin runoff we have found from the wall is much higher than what we find from a house driveway (usually under 10,000 ppt). The difference is probably due to the fact that the simulated driveway next to our wall is about 8 ft long, while our measurements from residential driveways are usually at least 25 feet from the treatments.

B. Runoff from residential homes 2014

Our trials this season are looking at the impact of band widths and buffer zones on runoff of bifenthrin and fipronil. Our trials are done at residential homes in Riverside as part of our summer ant project. Each treatment consists of 5 homes. (Some homes served a dual purpose by having both fipronil and bifenthrin treatments). Water samples for runoff analysis are collected 25 ft from the garage door on the driveway (see Fig. 4). Some of these treatments also include data on efficacy for ant control (up to 8 weeks in some cases), not yet tabulated. Final analysis of water samples has not yet been completed.

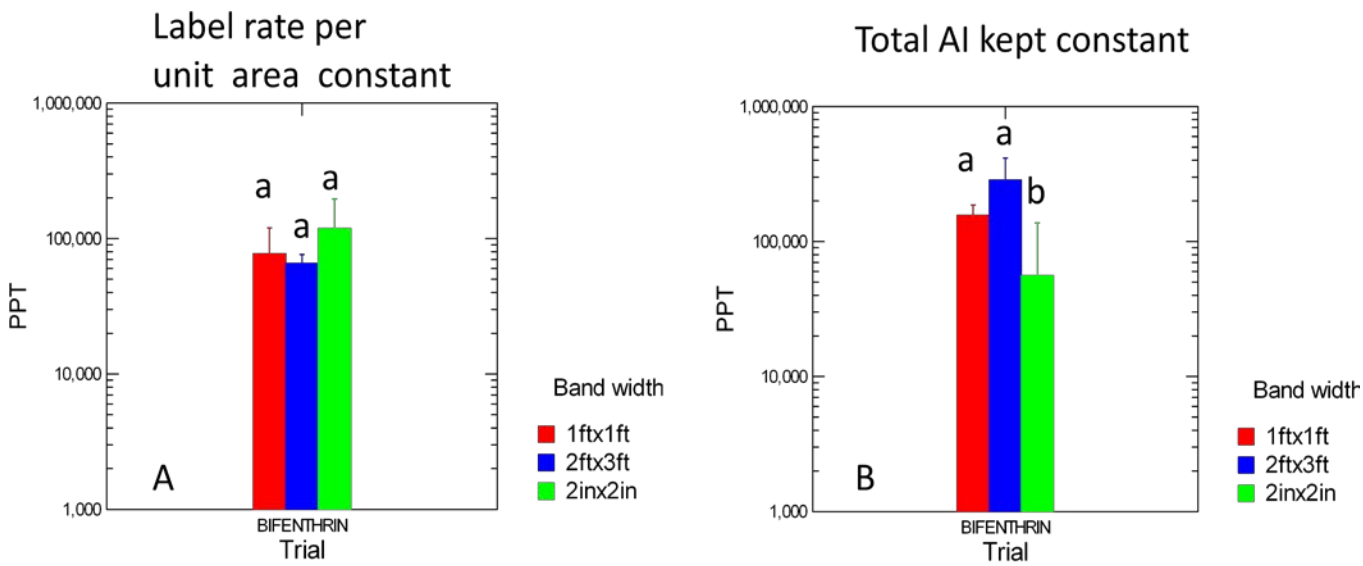
1. Fipronil trials
    a. Perimeter treatment using 1 ft band, with pin stream application at the garage door.
    b. Perimeter treatment using 1 ft band with 1 ft buffer from driveway
    c. Perimeter treatment using pin stream with 1 ft buffer from driveway
    d. Perimeter treatment using pin stream with 2 ft buffer from driveway

2. Bifenthrin trials
    a. Perimeter treatment 2 ft up and 3 ft out, 2 ft buffer from driveway
    b. Perimeter treatment 2 ft up and 3 ft out (2 ft buffer from driveway) plus crack and crevice along driveway/lawn interface
    c. Perimeter treatment 2 in x 2 in (2 ft buffer from driveway)
    d. Spot treatment only, 1 x 2 ft on lawn, 2 ft from driveway
    e. Spot treatment only, 1 x 2 ft on lawn, 6 ft from driveway

Figure 1. Concrete wall and pad constructed for testing insecticide runoff.

Figure 2. Collecting 1 liter water sample at one segment of wall. There are 24 segments in all.

Figure 3. Runoff of bifenthrin from concrete wall and pad. Graph shows mean runoff with standard errors. Bars with the same letter are not significantly different. (A) Label rate constant for different band widths. (B) Amount of active ingredient constant for different band widths.



A. Differing amounts of bifenthrin AI per treatment (same label rate of application, up to 1 oz per 1000 ft^2).

B. Same amounts of bifenthrin AI per treatment

Figure 4. Collecting 1 liter water sample on driveway of a residential home.