A step to mitigate sticky cotton in California

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California cotton has a reputation of quality for use in the production of high-quality fabric. However, this high quality is threatened by sticky cotton and the insects that create sticky cotton. Cotton aphid and silverleaf whitefly excrete sugar-filled honeydew that can contaminate cotton fiber, reducing the quality of the cotton and creating downstream headaches with processing. The sugars melt during processing at the gin and mills, causing problems.

Current situation

Insecticides are heavily relied upon to manage cotton aphid and whitefly populations in California. A number of materials are registered for use in California, although heavy pest pressure can mean that multiple materials need to be rotated to achieve control. In addition, a number of materials have been restricted due to regulation. For instance, chlorpyrifos, a material widely used for these pests recently had its use eliminated.

The challenges posed by these pests means we need to optimize the performance of the tools for which we do have access. We likely can achieve the best performance of the available insecticides through effective coverage of insecticides in the plant canopy.

Effective coverage would consist of sufficient distribution of insecticide droplets throughout the cotton canopy. Unfortunately, mid- to late-season applications often have dense plant canopies to contend with, making it difficult to get material to all of the aphids and whiteflies feeding on the undersides of leaves.

Examining spray coverage

We currently have a grant-funded project funded by California Department of Pesticide Regulation to improve management of aphids and whiteflies. This funding was made available with the removal of chlorpyrifos from the market. As part of this project, we are examining the interplay between coverage and efficacy. We have started by measuring spray coverage in some commercial applications to see what level of coverage is achieved.

We used water-sensitive paper (WSP) spray card to measure the spray coverage in several cotton fields during mid- to late-season sprays. This project is ongoing, but we will focus on three applications: a ground application at a 20 GPA volume, a fixed-wing aerial spray at 5 GPA, and a fixed-wing application at 10 GPA. Aerial applications were applied to comparable cotton plantings.

We put cards at multiple locations in the field and multiple locations within the canopy. We collected spray coverage data from two fields receiving commercial insecticide applications. The WPSs are yellow and 2×3 in. size that changes color wherever they come into contact with water (Fig. 1 and 2). On each plant, we deployed two WSPs−one on the fifth node and the other one was on the 9th node. In total, we used 60–72 WSPs in each field before the field was

sprayed. After the application, we collected the WSPs and scanned them individually using a scanner. The scanned images of WSPs were analyzed using the software to calculate percent spray coverage for each WSP.

Results and ongoing work

For the ground application, we saw 23.9% coverage at the top of the plant (5th node), while coverage dropped to 14.6% once we moved further into the canopy (Fig. 3). For the aerial spray at 10 GPA, the spray coverages were 3.6% at the 5th node and 1.6% at the 9th node. When volume dropped to 5 GPA, coverage dropped to 2.4% at the 5th node and was at 0.9% at the 9th node. It should be acknowledged this coverage was measured in specific applications, so this is not what should always be expected as variables like weather, equipment, and applicator technique come into play. It is not unsurprising that we are seeing lower coverages with aerial applications. With lower volumes, the mixtures being sprayed is of course more concentrated since the amount of insecticide in the tank would stay constant if the per acre rate was the same while spray volume is reduced. However, the volumes of the aerial and ground applications were different by factors of 2 or 4 (10/5 GPA vs 20 GPA) but the percent coverages were 10 and 7 times higher in the ground applications (Fig 3). Surprisingly, coverage did not drop as much as we expected from 5 to 10 GPA, meaning insecticide deposited and efficacy may not have been affected.

We still need to learn more about how these variations in spray coverage, paired with variation in spray concentrations affect control achieved for whitefly and aphid in cotton. We are working to answer this question in the laboratory by mirroring these spray coverage data in our track sprayer with multiple insecticides used for cotton aphids and whitefly.

What should you do

We think a key thing to consider and think critically about when spraying for aphids and whiteflies is what type of coverage you are getting. We already know that coverage can be a challenge and with the materials currently available, we cannot count on a "fuming" action so getting material on the leaves is critical. Ground applications (vs. aerial) will of course help get better coverage but is not always possible logistically. Applications should follow best practices and manipulating volume may be one way of achieving better efficacy, but we still have more to learn. In addition, to learn what is happening when you make applications, you could deploy spray cards. The only thing to keep in mind is that high humidity (e.g., evening/early morning) can turn them blue and picking up cards after an insecticide application means PPE is involved. Where possible, a test run with only water would be an option. There are several different brands of spray cards. Aphid and whitefly management in cotton is a challenge, so hopefully best practices that affect coverage can help achieve optimal results.

Further Information: For further information feel free to contact: Buddhi Achhami (bachhami@ucdavis.edu) or Ian Grettenberger (imgrettenberger@ucdavis.edu), both at UC Davis. This project also includes Peter Larbi with UCANR.
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Fig. 1: Water sensitive papers on cotton plant (Fifth and ninth node)

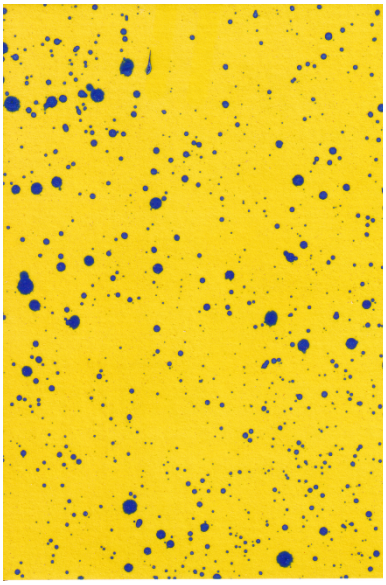

Fig. 2: Water sensitive paper with spray droplets

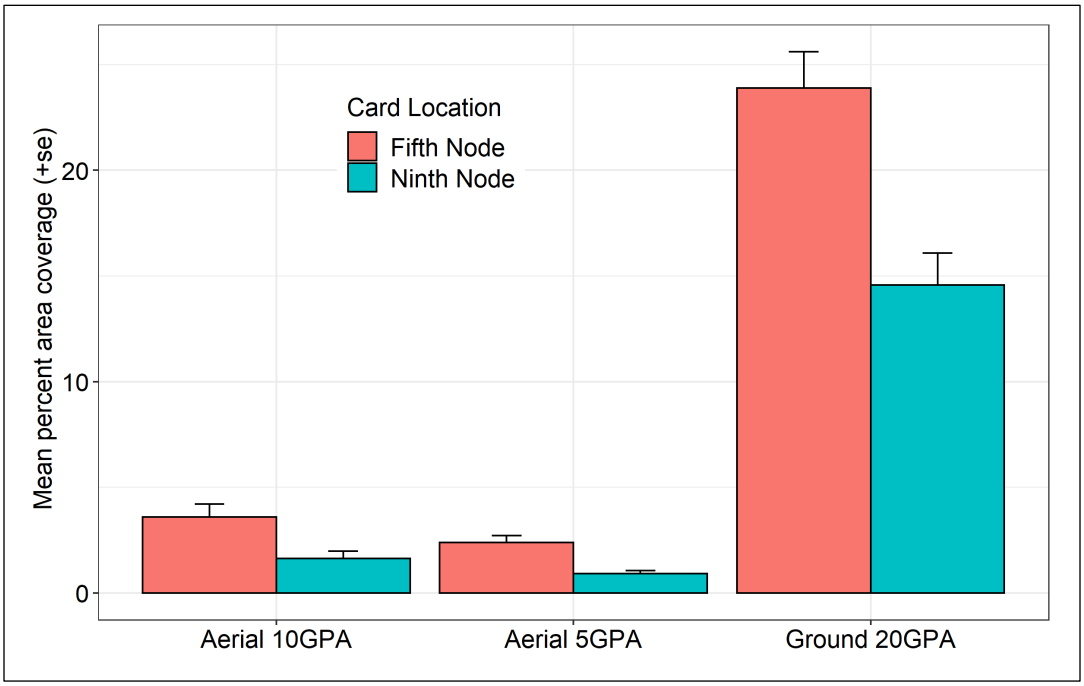

Fig. 3: Mean percent coverage by card location and applications