California AvoTech

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Pesticide Resistance Issues Facing California Avocado

How resistance develops

Pesticide resistance occurs when a pest population evolves the ability to survive exposure to a chemical that once provided effective control. After a chemical treatment, a few naturally resistant individuals survive. When they reproduce, they pass on those traits to their offspring. Over time, repeated use of the same product or mode of action allows resistant individuals to dominate the population.

Pesticide resistance can develop in insects, plants and any other biological organism that are controlled for with pesticides. Insects like thrips are especially prone to resistance because of their biology. They reproduce quickly, can produce multiple generations per year and can reproduce asexually (without a partner), passing resistance traits directly to their offspring without the gene dilution that occurs during mating. Resistance in insects also can occur through multiple mechanisms—including changes to the insect enzymes that detox chemicals, changes in the insect's outer cuticle that reduce chemical penetration or changes to insect behavior that allow pests to avoid contact with sprays.

In plants, resistance occurs because the plant population grows quickly, has efficient seed dispersal or has high genetic diversity. Many plants have the ability to handle natural toxins or enemies and have genetically coded defense mechanisms that can be co-opted to process and break down man-made pesticides. This creates opportunities for evolution to favor resistant plant individuals. Plants will respond to repeated exposure to the same herbicide, and heavy reliance of glyphosate in orchards exacerbates selection pressure, allowing resistant plants to spread.

At-risk chemistries

In California avocado production, two widely used chemistries face particular risk of resistance: abamectin for avocado thrips and glyphosate for fleabane. Since its registration in 2005, abamectin (Agri-Mek®) has been a cornerstone of control for avocado thrips (*Scirtothrips perseae*) because it is effective and relatively safe for beneficial insects. However, avocado thrips can have multiple generations per year in coastal groves, and abamectin's long persistence in leaves means multiple thrips generations may be exposed to the same chemical residue. Compounding this risk, abamectin is sometimes applied later in the season for persea mite control, further increasing selection pressure.

On the weed management side, fleabane and horseweed (*Conyza spp.)* present a parallel challenge. These weeds produce thousands of seeds per plant, disperse efficiently by wind and can germinate throughout the year. They run rampant in rainy years and can be a big problem in young orchards (in older orchards, ground shading and self-mulching can limit them). California growers have historically relied heavily on glyphosate as a primary control tool, so populations of glyphosate-resistant fleabane have already been documented in orchards and other cropping systems across the state. Once resistant plants establish, they can rapidly spread within and between groves, leaving few effective post-emergent options.

The importance of rotating active ingredients

The best way to delay resistance is to reduce selection pressure. This means avoiding back-to-back applications of pesticides with the same mode of action. The Insecticide Resistance Action Committee and Herbicide Resistance Action Committee classify products by mode of action code—rotating between these codes is a key strategy.

For avocado thrips, this might mean alternating abamectin with spinetoram or other alternatives, especially when selecting a product for fall persea mite applications. Releasing predatory mites also can be used for persea mite control, although it is expensive. For weeds, integrating pre-emergent herbicides like glufosinate (similar in name to glyphosate, but a different product) with mechanical practices can lower the risk of resistant fleabane. Improving spray coverage and carefully timing applications to target the youngest life stages also help conserve the efficacy of any given product. Given that new chemistries can take years to become commercially available, rotation and integration are essential for ensuring the tools we rely on today will remain relevant.

Monitoring pesticide resistance

Recognizing the urgency of this issue, the California Avocado Commission is funding new research to establish a pesticide resistance monitoring program for avocado thrips in Ventura County. Our project is led by UC Cooperative Extension in collaboration with UC Riverside and will develop bioassay methods, establish monitoring sites across the county and measure baseline resistance levels to abamectin.

Our goal is to generate the first regional resistance data in more than a decade and share results directly with growers. This program will provide the foundation for future diagnostic services, allowing growers to determine whether control failures are due to resistance or other factors such as timing or coverage. If you'd like to be kept in the loop for more updates, email me at hcohen@ucanr.edu to be added to the Topics in Subtropics Newsletter, a University of California extension publication that is published four times a year with research updates about subtropic crops.