Management of Pesticide Resistance

This multidisciplinary project continues to develop resources, tools, and methods that significantly reduce the threat of pesticide resistance, thus helping to sustain the usefulness of important pest management tools and strategies, reduce losses from pest damage, and protect public and environmental health.

Who cares and why?

Pesticides are important tools used in managing pest populations; however, some individual pest organisms are naturally resistant to pesticides. These resistant individuals survive and reproduce, passing on genetic resistance to generation after generation until most of the population is resistant and certain pesticides are no longer effective. In recent years, use of conventionally-applied herbicides, fungicides, and insecticides has increased significantly and pesticide resistance has multiplied rapidly. In addition, some insect pests have developed resistance to insecticidal proteins that are expressed in genetically modified plants. When resistance develops and commonly-used pesticides fail to control pest populations, damage to crops, property, and landscapes intensifies and costs skyrocket. For example, cotton growers in the southeastern U.S. face serious crop losses due to weeds that are resistant to the commonly-used pesticide, RoundUp®. Soybeans, rice, and other crops are expected to face similar problems soon. Pesticide resistance often leads to overuse or misuse of pesticides, risking harm to the environment and public health and making the crops less desirable to certain markets and consumers. Quickly and successfully addressing pesticide resistance requires the work of scientists from many disciplines and up-to-date information. Managing pesticide resistance also relies on persistent monitoring and consistent, effective strategies in the field. Better management of pesticide resistance will lead to improved protection from pests, a more stable supply of quality crops for consumers, better profits for growers, and healthier humans, animals, and environments.

Even though many kochia plants— highly invasive weeds—were killed by RoundUp® treatments, a track of healthy kochia plants grew in the field above when a a single RoundUp®-resistant plant shed its seed as it tumbled across the field in the wind. Photo by Andrew Wiersma, Colorado State University. Along with weeds, plant pathogens can also develop resistance to pesticides. For example, fungicide-resistant powdery mildew can severely damage pumpkin crops. Photo by Meg McGrath, Cornell University.

What has the project done so far?

Over the past five years, WERA-060 researchers and extension specialists have worked with industry representatives and government regulators to develop resources, tools, and methods for managing pesticide resistance. Researchers have detected resistance in a wide variety of pests—including insect pests, plant pathogens, and weeds in cotton, peanut, corn, squash, and melon—and have described how resistance develops in many situations. Scientists have also developed guidelines for preventing pesticide overuse and misuse and have evaluated how well new pesticides control pests and how quickly, if ever, pests develop resistance. Other studies have determined how new pesticides impact non-target species and the economy and how well they are accepted by users and communities. In addition, researchers have investigated how to block the genes and specific mutations that cause pesticide resistance. To share research findings, the group has organized symposia about pesticide resistance management, produced over 20 educational videos (*http://ag.arizona.edu/crops/vegetables/videos.html*), revised and expanded training programs, delivered updates to farmers via web, email, and smart phone (*http://ag.arizona.edu/crops/vegetables/advisories/advisories.html*), organized online databases, and distributed newsletters.

Impact Statements

Advanced data, tools, and strategies for preventing or delaying the evolution of pesticide resistance in pest populations by enabling cooperative research and extension.

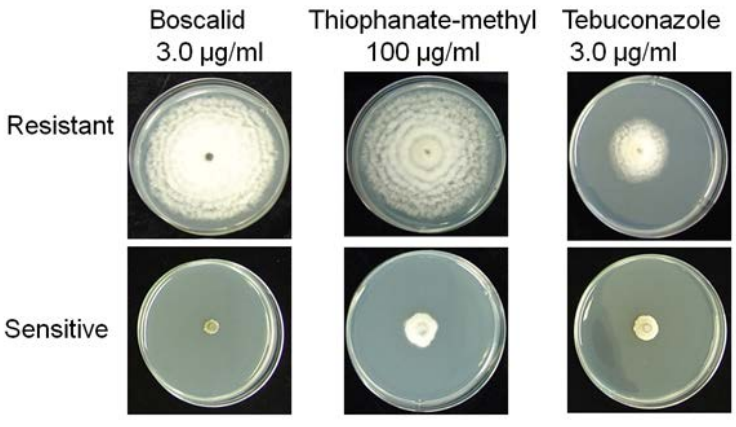
Helped farmers, pesticide manufacturers, and regulators make more economically and environmentally sustainable decisions by sharing data, tools, and recommendations.

Helped users choose and apply pesticides properly by developing and updating management guidelines. Proper pesticide use prevents resistance build up, reduces damage from pests, saves time and money, minimizes pollution, and lowers health risks.

Detected new cases of pesticide resistance, getting the upper hand on these cases before they cause serious problems.

Made it easier to monitor pesticide resistance by creating the Arthropod Pesticide Resistance Database (APRD), which has encouraged online pesticide resistance case reporting and has become the most complete database on resistant organisms in the world. Pest managers, industry specialists, researchers, the EPA, and the EU use the database to support pesticide registration and decisions about managing cases of pesticide resistance.

Above, a graduate student working with a WERA-060 scientist samples plants for pesticide-resistant gummy stem blight. In the lab, tests revealed that the gummy stem blight is resistant to multiple types of pesticides. The gummy stem blight samples that are resistant to pesticides continued to grow in the petri dishes (below). Photo and chart courtesy of Katherine Stevenson, University of Georgia.



What research is needed?

There is a critical need for scientists to quickly develop ways to combat pesticide resistance and to work with policymakers to set guidelines for using and enforcing these tactics. RoundUp®-resistant weeds and Neonicotinoid-resistant insects are of immediate importance. In general, research is needed to better understand the biology and genetics that underlies pesticide resistance and to ensure more precise and accurate predictions about when and where pesticide resistance may develop.

Want to know more?

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Compiled and designed by Sara Delheimer