



RAMPing Up Against Lygus

By Susan McGinley

After holding the title of No. 1 pest in Arizona cotton for the past 10 years, the Lygus bug is now the focus of a four-state effort to suppress its reach and reduce its potential damage across multiple crops.

In cotton alone, yield losses to this serious pest have averaged over \$6.9 million annually in Arizona for the past 10 years. Across the Cotton Belt, Lygus infested more than five million acres in 2007. Nearly \$100 million was spent on sprays, but despite these control efforts, over \$50 million was lost in yield to Lygus. In addition to cotton, Lygus attacks a wide array of vegetable, field and fruit crops, and will migrate to susceptible new crops introduced to an area.

Although Arizona cotton growers have kept Lygus at bay since 1999 through an effective integrated pest management (IPM) program, the insect has expanded its feeding range across the Southwest, calling for a more comprehensive approach.

Thanks to a \$2.5 million grant from the USDA-Cooperative State Research, Education and Extension Service's Risk Avoidance & Mitigation Program (RAMP), scientists, growers and agricultural industry representatives in California, Arizona, New Mexico and Texas are working together to reduce the risk of Lygus infestation at three levels: the individual grower's field, the local landscape and the wider ecosystem. The program includes co-principal investigators from USDA, University of California, New Mexico State University, Texas A&M and the UA as the lead institution.

"We want to develop the know-how to be able to understand Lygus movement and ecology so growers can more strategically arrange their landscape to minimize the damage," says Peter Ellsworth, University of Arizona entomologist and lead investigator for the Lygus RAMP team. "We're looking at crop densities and crop placement that make Lygus infestations better or worse, investigating the pest's movement potential and testing safer methods for controlling Lygus in at least 10 crops."

A large-scale risk management program for Western crop systems

The four-year RAMP study specifically targets Lygus populations in upland and Pima cotton, cauliflower and broccoli grown for seed, romaine lettuce, eggplant, chile, alfalfa, dry beans, guayule (grown as a latex source) and lesquerella (a new oilseed crop). The goal is to help growers improve their productivity and profitability in Lygus-infested crops.

After obtaining funding in 2006, the RAMP team began its first full field study in summer 2007. One Arizona grower was able to manage 1200 acres of cotton during the late season with a reduced-risk insecticide, based in part on the research and guidelines that were developed.

The large-scale applied approach builds on three established components of IPM: 1) sampling pest populations in fields, 2) spraying only when needed, with safer chemicals that don't interfere with natural controls and 3) avoiding risk through altered planting dates, crop placement, use of resistant varieties and other production techniques.

The project includes an ambitious, expanded Lygus sampling and mapping project on 60 growers' farms and surrounding areas in the San Joaquin Valley in California, in Central Arizona and in West Texas, encompassing more than a million acres of land.

"We'll have a nice series of contrasts in the comparative study," Ellsworth says. "Perhaps Lygus movement in a simple system is different than it is in very large fields. We don't know. But by having these three windows into pest movement across a landscape we'll have that much more insight on how to advise growers."

In Arizona, RAMP team members at the USDA-Arid Land Agricultural Research Center developed a series of protein markers to track Lygus bugs. The USDA research entomologists include Jackie Blackmer and Steve Naranjo, who are also adjunct UA entomology research scientists, and James Hagler. The technique involves spraying milk casein, soy or chicken egg proteins on different crops for Lygus to pick up when they land or feed. Traps placed at varying distances from the fields collect the bugs, which are taken back to the laboratory and matched to the fields they came from by the substance detected on their bodies. These studies tell the researchers where and how far Lygus are moving in and out of fields.

Meanwhile, UA scientists Yves Carrière, Christa Kirk and Ellsworth, as well as cooperating scientists in Texas and California are using global positioning systems (GPS) coordinates from the Arizona Cotton Research & Protection Council to develop statistical tools for understanding spatial-temporal aspects of Lygus distributions and movements over different cropping communities. Measurements of the crop diversity in an area will be correlated to risks for damaging levels of Lygus nearby. With this information, Ellsworth says, “we’ll be able to advise growers about crop placements that reduce the risks of Lygus damage on their ranches, or more broadly, in their production region.”

Along with monitoring, the researchers hope to find new compounds with reduced toxicity, and examine their compatibility with beneficial, nontarget insects. In 2007, Arizona Cooperative Extension programs in one major cotton-producing county helped growers switch from using broadly toxic Lygus insecticides to a new, reduced-risk insecticide that offers better opportunities for natural biological control. Where 100 percent of the sprays in 2006 were broad-spectrum, 52 percent were the reduced-risk type by 2007.

“It’s all about managing the pests and natural enemies within the system, maintaining a reasonable balance,” Ellsworth says. “The system should only require the occasional input of a key pesticide—one with minimal negative impacts on the predators and parasites that assist pest control. The other element is the whole avoidance basis: area-wide impact of “source-sink” relationships on Lygus

movement, crop placement, host management, inter-crop movement and ultimately, cross-commodity cooperation.”

The term “source-sink” refers to fields where Lygus either explode or dwindle in population. Some plant species serve as a “source” for Lygus by attracting it and offering an environment where it multiplies and then moves on to attack nearby crops. Other plant species may be a “sink” for the pest, luring the bug to move in and then retaining its population where it cannot cause damage—a good thing in a crop situation.

“Growers already know that planting seed alfalfa next to cotton is going to be a serious issue for the cotton grower,” Ellsworth explains. “They also know that if they’ve got cotton next to safflower they’ll be spraying over and over in the cotton until the safflower is dried down and stops ‘sourcing’ Lygus to surrounding crops.”

Some of the RAMP studies are focusing on which crop and non-crop plants are sources and which are sinks for Lygus, since not all of these interactions are known, particularly for new crops. When new plant species are introduced to an area, market demand and related economic benefits are often given precedence over concerns about how the existing pest populations will interact with the new crops. The RAMP team will determine which crop placements are safer and which are more risky.

“In Arizona we’ve got sweet sorghum, guayule and lesquerella that are about to be planted on a wide scale for the first time,” Ellsworth says. “Are we seeding our entire landscape with a Lygus nursery that’s going to affect our sensitive crops negatively? Or can we use these crops as a sink or ‘sponge’ to suck up all of the Lygus in the landscape? That’s what we want to find out.”

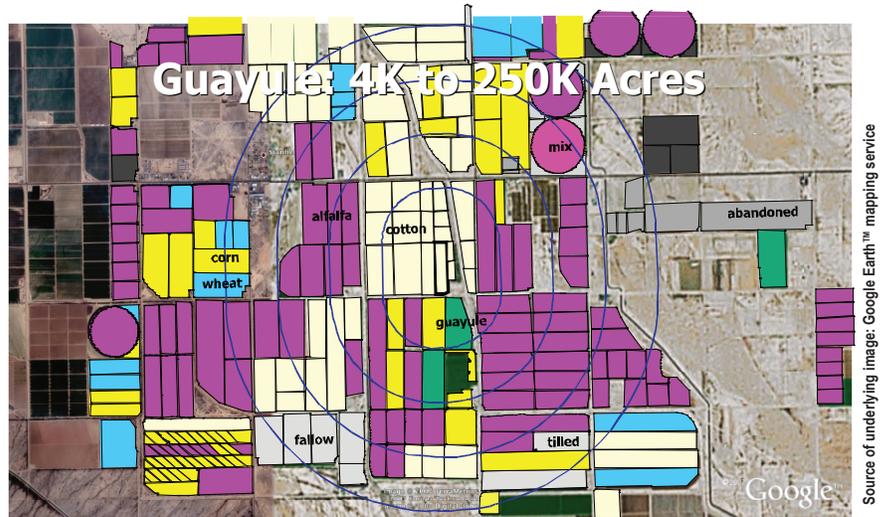
In all, the RAMP strategy includes 32 subprojects. RAMP participants will progress from research and development to information outreach and implementation. Grower education will include print and electronic publications, field days and on-farm demonstrations, meetings and seminars, grower participatory research and interactive training. There will be a detailed evaluation, headed by UA extension scientist Al Fournier with contacts from the four states, to assess impact of the program.



“In the end, what’s really neat about the RAMP program is we include everything from fundamental science and applied science to delivery, outreach and implementation,” Ellsworth says. “We’ll put the information in the hands of the growers and they’ll manage their acreage with new tools and a new understanding of how to avoid problems with Lygus.”

As a way to try that out with no risk initially, a computer gaming simulation for growers will be developed with the help of a private consultant, Andrew Corbett in California, and conducted through Cooperative Extension with Ellsworth, Fournier, cooperating county agents, and UA agricultural economist Russ Tronstad. The simulation will gather all of the principles developed through the research into a practical model for designing a crop management plan. For example, growers may be given a virtual 1,000 acres to develop into cotton, small grains and other crops, and requested to arrange them spatially on their acreage.

“Then we’ll run the simulation community and see what the Lygus risk is,” Ellsworth says. “We’ll explain what we know about Lygus and how it moves; what is a source and what is a sink at this time of year, and tell them the risks of planting one crop near another.” Next, the participants will have an opportunity to dialog with their “virtual” neighbors and redesign how they’d plant the 1,000 acres, and the simulation will be run again, taking into account how they would



Reference map for Lygus populations shows a cotton field in the center. Fields were chosen at random throughout Arizona, California and Texas. Lygus bug populations were sampled weekly during the summer of 2007, and the location of every agricultural field and the crops grown were mapped out to a radius of 3 km. Scientists believe this is the range where Lygus can have an impact.

spend the least in pest control and how they would collaborate with nearby growers.

“It’s just another way producers can look at the landscape,” Ellsworth says. “They already know what’s out there, but they just don’t have the specificity of the information. That’s the training. It’s where we see agriculture going: very knowledge-intensive.”

Ellsworth says it takes a vast set of information to farm “on an inch-level” with GPS. Growers already do this across their fields with water and other inputs.

“But pests are a biological entity, and we’ve never had all the tools in place to do what we want to do right now. We want to manage agriculture as an ecosystem.” ★

Arizona Pest Management Center

Lygus RAMP project

<http://cals.arizona.edu/apmc/RAMP.html>

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