RETROSPECTIVE of the REGIONAL IPM GRANTS PROGRAM

Regional Focus. National Benefits.

A joint report by the
Regional Integrated Pest Management Centers

Regional IPM Centers

Through the Regional Integrated Pest Management Grants Program, the USDA's National Institute of Food and Agriculture helped develop safer ways to manage pests.

Known as RIPM, the purpose of the Regional Integrated Pest Management Grants Program was to develop knowledge to expand integrated pest management practices nationwide.

IPM is a science-based approach to managing pests that uses the pest's biology, environment and all available technology to reduce pest damage to acceptable levels, and do so economically. The goals of IPM, and the RIPM program, were to:

- Reduce health risks from pests and pest-management practices
- Reduce environmental risks from pests and pest-management practices
- Improve economic outcomes for those practicing IPM

The Regional Integrated Pest Management Centers began administering the annual RIPM grants competitions in the mid-2000s – selecting the review panels and submitting a list of projects recommended for funding to USDA-NIFA. The Centers fulfilled this role until 2014, when several pest-management programs were combined into a new federal funding line known as the Crop Protection and Pest Management Competitive Grants Program.

This retrospective of the Regional Integrated Pest Management Grants Program highlights some of the important and varied research and extension conducted while the Regional IPM Centers administered the grant program. On the pages that follow, you'll find highlights of four projects from each of the USDA regions. The diversity of projects shows not only the tremendous regional variation in agricultural and urban pests, but also illustrates the effort and creativity researchers and extension specialists around the country bring to the table every day to solve those pest problems.

Many of the projects highlighted here were small pieces of ongoing research and extension programs that stretched across years and created and expanded IPM practices for some of the nation's most important crops. That work continues in laboratories across the nation. RIPM projects also helped develop management strategies for important urban and school pests, and helped expand IPM practices to control pests in natural areas.

As they did by administering the RIPM program, the Regional IPM Centers continue to promote the development, adoption and evaluation of integrated pest management to benefit the people, environment and economy of the United States.

Western Region

From 2003 to 2014, the Western IPM Center organized the RIPM review panel in the West, which selected 72 projects for funding based in part on regional priorities. Of those, 66 research and extension projects have been completed. They involved 83 project directors and 107 collaborators in 15 universities across all 13 Western states.

The RIPM program contributed significantly to the expansion of available IPM tools and practices for Western agriculture, and growers use those tools to manage pests in ways that reduced risks to people and the environment while protecting their economic bottom line. The $6.1 million invested leveraged at least an additional $8.2 million in funding, and resulted in a much larger overall economic benefit to Western growers and consumers.

www.westernipm.org

CREATING TOOLS AND TESTS FOR IRIS YELLOW SPOT VIRUS IN ONION

H. F. Schwartz, Colorado State University

Iris Yellow Spot Virus is a viral disease of onions that is transmitted by thrips and can devastate onion fields. First discovered in the United State in 1989, Iris Yellow Spot Virus is now one of the most serious problems for Western onion growers.

In 2007, two Western researchers received RIPM funding to combat the disease. Howard Schwartz at Colorado State University identified onion cultivars with greater resistance to the virus and also determined that crop rotation, sanitation, weed management and cultural management to reduce crop stress are all components of an IPM program for Iris Yellow Spot Virus on onions.

That same year, Hanu Pappu at Washington State University developed a rapid and practical Enzyme-Linked ImmunoSorbent Assay – known as an ELISA test – for the virus. He then used the test to identify Iris Yellow Spot Virus in volunteer Alliums, weeds and in thrips, showing that growers should control volunteer hosts of the virus in order to reduce sources of infection. A company is developing Iris Yellow Spot Virus test kits based on the antibodies identified by this project.

The recommendations of both researchers have been adopted by onion growers in the West to manage the disease-insect complex.

PEST-DEVELOPMENT MODELS LET GROWERS ADOPT IPM PRACTICES

For growers who want to adopt IPM practices, knowing when to take action against pests is critical. To make those decisions, they need accurate pest-development models tied to local weather information.

In short, growers need exactly the information provided on the **www.uspest.org** website, a decision-support tool developed, expanded and improved in part through RIPM funding.

In 2003, 2005 and 2009, Len Coop at Oregon State University received RIPM grants that helped build and expand uspest.org into a national resource. The site provides 82 degree-day and 23 hourly weather-driven insect- and disease-development models. It draws data from more that 24,000 weather stations throughout the United States, and can also create "virtual weather stations" anywhere, using data from nearby weather stations and topographical details to extrapolate weather information.

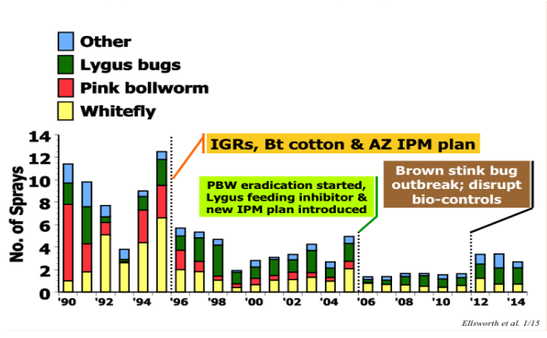
As uspest.org has expanded, the number of model runs by growers and pest managers has increased, from 32,000 in 2009 to more than 162,000 in 2013. That year, there were more than 45,000 degree-day phenology model runs, 57,000 hourly plant disease and related model runs, and 43,000 Google map views of late blight, fire blight, Tomcast disease severity values, soybean rust and boxwood blight disease-risk maps.

This work became the foundation of the Weather-Based Decision-Support Tools Signature Program of the Western IPM Center in 2012.

IPM PROGRAM IN COTTON SHOWS IMPRESSIVE SAVINGS TO GROWERS

Along Arizona's southern border with Mexico, the importance of extension IPM programs could be seen in the cotton fields. In Arizona, pesticide use was declining markedly, while in Mexico, growers were still spraying organophosphates and pyrethroids heavily – despite having access to the same pest-resistant cotton seed and other technologies.

The Arizona reductions (later replicated in Mexico) were in part due to an area-wide IPM program developed by Peter Ellsworth and colleagues at the University of Arizona, who received RIPM grants in 2005 and 2012 not only to help further develop IPM approaches for desert cotton, but also to document the impacts of adopting IPM practices. And those impacts have been impressive: the number of sprays growers made dropped from around 12 per year to about two a year, and the amount of pesticide active ingredient used dropped from four pounds per acre to one. Today, an average of 20 percent of cotton acreage in Arizona is never sprayed for insect pests because growers successfully manage the pests by other means.



Through IPM adoption, from 1996 to 2014 Arizona cotton growers cumulatively saved $451 million and prevented more than 21 million pounds of insecticide active ingredient from reaching the environment. These impacts were documented through the Crop Pest Losses and Impact Assessment Signature Program of the Western IPM Center, created in 2012 after several years as a Western IPM Center-funded work group.

DEVELOPING A RAPID TEST FOR FIRE BLIGHT IN PEARS AND APPLES

University of California

Fire blight is one of the most destructive diseases in pear and apple trees. And back in 2008, while there was a weather-based model to predict fire blight outbreaks, it had one serious flaw – the model assumed the pathogen was omnipresent. Because there was no timely test showing if the pathogen was actually present, growers had to spray when the weather dictated, whether their orchards really needed it or not.

That's changing, thanks to a RIPM project led by Ken Johnson at Oregon State University. Johnson used the funding to develop and test a DNA-based rapid detection protocol for the fire blight pathogen that produces results in an hour, in the field, without fragile equipment.

The test uses loop-mediated isothermal amplification of DNA, called the LAMP method, to easily and rapidly detect the fire blight pathogen. The extension diagnostic labs in Utah and Oregon adopted the LAMP detection assay for routine fire blight diagnosis, and the Oregon lab developed two more bacterial pathogen diagnostic assays based on the same technology.

While initially too technically demanding to be a do-it-yourself test, six companies are working to develop sample processing kits to bring DNA testing to farms and farmers who can use it.

SLOWING THE SPREAD OF GIANT RAGWEED THROUGH REGION-WIDE MANAGEMENT


Chris Boerboom

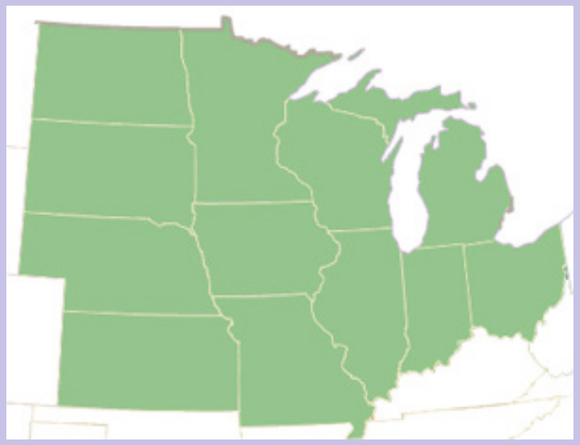
Giant ragweed is a major weed for farmers and allergy sufferers in the North Central Region of the United States. It is escaping current management tactics and expanding into previously non-infested areas. This RIPM grant funded research resulted in new best management practices to curb the weed's expansion.

Management approaches are poorly diversified and herbicide-resistant populations have increased dramatically in the last 10 years. The goal of this research was to identify the key causes of giant ragweed spread, predict areas that are vulnerable to invasion, and develop new guidelines for giant ragweed management.

The research team used historical data and statistical modeling tools to determine how giant ragweed has spread - escaping natural constraints and spreading across human-altered landscapes.

The researchers hosted an all-day symposium on "Giant Ragweed Biology and Management" at the North Central Weed Science Society Annual Meeting. In addition, experts in giant ragweed biology and management from across the North Central Region were brought together for three three-day meetings at Ohio State University.

North Central Region



The North Central Integrated Pest Management Center began managing the North Central Regional IPM Grants Program in 2003.

During the 11 years the Center provided oversight, the program received 449 proposals and funded 96. The RIPM grants program offered applicants three types of funding opportunities including research-only awards up to $100,000; extension-only awards up to $80,000; and research and extension awards up to $175,000.

While these amounts are modest compared to many other competitive funding programs, these funds have addressed critical pest issues and educated diverse audiences about IPM's role in sustainable and organic pest management from field crops to community settings and schools.

www.ncipmc.org

DEVELOPING AQUACULTURE IPM STRATEGIES AND TRAINING FOR FISH FARMERS IN MISSOURI


Alejandro Linares Garcia

Aquaculture is growing and fish are predicted to be a main source of food for the world in the future. The greatest economic loss and threat to farmed fish is disease, often caused by pests.

Historically, fish farmers have not monitored their fish health, leading to disease infestations. Also, many pests have traditionally been unidentified or did not have an approved treatment available.

This RIPM project identified the need for developing and implementing aquaculture IPM strategies, and began building a network of informed and supportive fish farmers, researchers, professors, veterinarians and related stakeholders.

Efforts which empower fish producers to reduce costs for pest treatments are economically beneficial. But monitoring is also key to understanding fish health. Developing a proactive approach can lead to disease prevention and IPM strategies can prevent these losses and lead to more profitable products and a safer environment.

Before this study, aquaculture IPM strategies had yet to be developed in the North Central Region. Another outcome is improved communication resulting in fish farmers becoming more receptive to aquaculture IPM.

TESTING SPOTTED WING DROSOPHILA SOLUTIONS FOR BERRY GROWERS

Spotted wing drosophila is an insect pest that economically affects soft skinned fruit, including berries. Researchers from three states teamed up to test the effect of nearby woodland landscape on infestation levels and to determine if exclusion netting can prevent damage and lessen the need for chemical control.

Findings were shared with producers while also educating them on best management practices.

Spotted wing drosophila was first detected in the region in 2010 and has caused significant damage and crop losses. During the studies, adult insects were trapped and larvae were counted to ascertain infestation rates. This data was posted on the University of Minnesota Fruit-Edge website at www.fruitedge.umn.edu.

Information obtained from these studies was also presented at growers meetings, through webinars and announced on a central website hosted by Michigan State University, which has had over 20,000 page views.

EVALUATING IPM APPROACHES TO BED BUG MANAGEMENT IN PUBLIC HOUSING

Bed bugs are a serious economic and medical pest that continues to spread because they are cryptic and nocturnal making monitoring and early detection difficult.

Bed bug infestations have increased dramatically in recent years throughout the United States and bed bugs are quickly emerging as a major public health pest. Available treatment methods are expensive, time-consuming, and often ineffective due to insecticide resistance.

A RIPM grant funded research on an innovative and inexpensive system to control bed bug infestations while significantly lowering human exposure to insecticides.

Researchers launched an experiment where sports tape impregnated with insecticide dust was wrapped around furniture legs. They determined the inexpensive device can be made without tools or prior experience and offers a highly localized insecticide delivery system that is highly effective.

Current practice is to apply large amounts of pyrethroid insecticides. The amount of active ingredient per apartment could be reduced two-million-fold with the new system. Researchers noted the approach could be used worldwide and will investigate commercialization of the device.

The project included educating and training of public housing staff who will serve as "change agents" in proper selection and use of chemical and non-chemical tools for bed bug management.

REDUCING FUNGICIDE USE WITH LATE BLIGHT WARNING TOOLS

Late blight is the number one disease risk on 1.2 million acres of U.S. potatoes, and it's a serious concern for growers of 400,000 acres of tomatoes. The culprit is the same pathogen that created the Irish potato famine: Phytophthora infestans. Because there are no treatments, prevention is vital and when the weather favors late blight, many growers apply fungicides proactively, even if the pathogen isn't local.

Cornell University plant pathologist William Fry and others had developed ways to determine the timing of late blight outbreaks in potato and tomato so growers could spray fungicides only when needed. In 2010, with a two-year RIPM grant, Fry and Pamela Roberts from the University of Florida expanded a web-based decision support system from potatoes to tomatoes and incorporated fungicides with low environmental impact into the system. They also created a smart phone app and developed a model that could predict the need for fungicide application.

Today about 4,000 potato growers in New York have benefitted from their forecasting and alert program that helps users make well-informed decisions about when to protect crops. The program bases recommendations on data from the National Weather Service, the late-blight resistance of the potato or tomato cultivar, proximity to an inoculum source and the fungicides available to the grower. Growers using the system may reduce fungicide use 10 to 20 percent.

MAXIMIZING WEED CONTROL FROM COVER CROPS IN NO-TILL AG

For farmers of no-till field crops, it's a critical question: how much cover crop biomass will reduce or eliminate the need for herbicides?

In 2008, with RIPM funding, weed scientist Bill Curran of the Pennsylvania State University set out to find answers. Growers know cover crops of hairy vetch or cereal rye need to be crushed at their peak in the spring, but not so late that newly planted corn and soybeans can't grow to maturity. Curran and partners in Pennsylvania, Virginia and Maryland set out to find the sweet spot for minimizing weeds and maximizing field crops.

They looked at the fall planting date of the cover crop, the date in the spring when it is rolled into a weed-suffocating mat into which the field crop is planted, and how thickly cereal rye is planted.

The results? Cover crops need to produce 6,000 to 8,000 pounds of dry matter per acre to suppress weeds in the mid-Atlantic region. The fall planting date didn't matter as much as the spring termination date, as both vetch and cereal rye had to be rolled at just the right time or they'd spring back to life. The team's research gives growers specific recommendations for cover-crop termination depending on their location and field crop.

Supplemental weed control through cultivation or herbicides benefitted both corn and soybeans.

Clair Keene, Penn State University

HELPING URBAN RESIDENTS DRAIN ASIAN TIGER MOSQUITO HABITAT

Asian tiger mosquito is a striped beast that preys on humans during the day, has become the most important nuisance pest in many northeastern urban and suburban areas. Found in 30 states, it can reproduce in a bottle cap of water – or flower pots, clogged gutters and wading pools. And it likely transmits West Nile Virus.

Scientists know low socio-economic conditions produce a lot of habitat suited to the mosquito – shaded, medium-small trash containers – and the most practical solution would be for residents to drain and remove small water-holding containers and to apply mosquito dunk to large amounts of standing water. But how to teach and motivate them?

Susan Ellis, Bugwood.org

In 2011, with RIPM funding, University of Maryland ecologist Paul Leisnham set out to find out.

Leisnham's team visited 240 study households and distributed print educational material to 50 percent of them. But more than half of the surveyed residents who received materials never read them. More effective at reducing mosquito infestations in urban areas were active educational programs: articles in community newsletters, information tables at neighborhood events, workshops, citizen science programs where participants collected mosquito data, community representatives who sampled for mosquitoes and disseminated information to residents, and a church youth group's container clean-up program.

Even then, getting community buy-in proved challenging, but Leisnham believes developing long-term relationships with communities to build trust and visibility have the greatest chance for success.

DOCUMENTING INFECTION RATES IN MANAGED AND WILD BEES

USDA ARS

Seven years ago bee populations were tumbling, threatening the $130 million northeastern cranberry and blueberry industries.

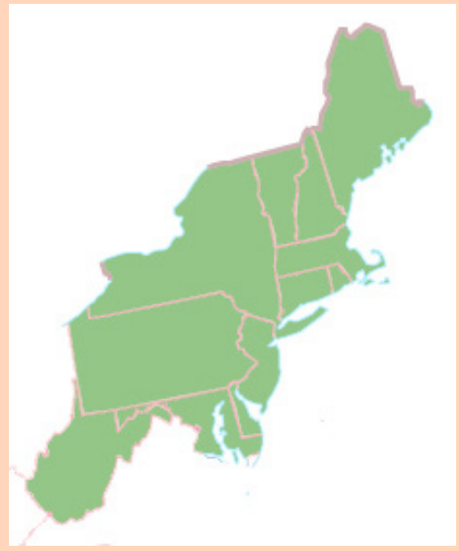
Microbiologist John Burand and colleagues at the University of Massachusetts and University of Maine knew that bees carry a complex array of viruses, bacteria and protozoa – some possibly good, but most bad and downright deadly. What they didn't know was which organisms were the top suspects in the decline, how to monitor for them, and how to track their spread. So they teamed up on RIPM project to find out.

They started developing diagnostic tools, and while other scientists were finding viruses by pooling samples of bees, Burand's team examined each bee individually.

They examined 300 bees from two sources in Massachusetts: local apiaries and migratory hives transported between locations to augment pollination. After analyzing for seven viruses, only 15 bees came up clean. Even in apparently healthy hives, 60 percent of bees were infected with more than one virus. Rates of infection were also higher in the migratory hives, leading researchers to conclude that movement of migratory bees was likely spreading the viruses around.

Also likely, says Burand, is that viruses are spreading between migratory bees and native pollinators like squash bees, mason bees, and unmanaged bumble bees as local pollinators in close proximity to migratory bees had higher levels of three honeybee viruses.

Northeast Region



In the past decade, the Northeastern IPM Center managed 71 RIPM grants – 40% focused on IPM research, 40% on research and extension, and 20% focused on extension. Vegetable crops were the stars of about a quarter of the projects, as were nursery, ornamental and turf projects. Urban and residential settings (including bed bugs and mosquitoes) made up 15%, and small fruit and tree fruit were 10% each. The remaining projects gave us knowledge about invasive species, ticks, cover crops, livestock, grapes and honey bees.

For a federal investment of $4.12 million in projects from 2007 to 2013, researchers obtained more than $7.02 million worth of additional funding – a 70 percent return on investment.

www.northeastipm.org

BROWN ROT RESEARCH SAVES PEACH GROWERS MILLIONS

Guido Schnabel, University of Georgia

In 2002, Southeastern peach growers discovered something they hoped they would never find – a strain of brown rot disease they could not kill.

During years of heavy rain and high humidity, brown rot (*Monilinia fructicola*) can reduce yields about 20% if untreated, and growers have only three fungicides available to treat brown rot. However, different strains of brown rot are showing resistance to one of each of the three fungicide classes, and in 2008, resistant *M. fructicola* disease cost growers $9.8 million in losses.

Peach production is a $69 million industry in South Carolina and Georgia, vital to the economy of both states. Guido Schnabel of Clemson University and Philip Brannen of the University of Georgia teamed up on three projects to manage *M. fructicola*. They developed an assay to test disease samples for fungicide susceptibility and developed an online recommendation system to prescribe the effective fungicide for each situation. Growers in both states use the system to manage resistance, and as a result now rarely find resistant brown rot.

For the $326,678 invested in three RIPM grants, peach growers have saved an estimated $4 to $10 million annually. Schnabel further leveraged this work by building a similar system for Botrytis in strawberry. Savings in both peach and strawberry totaled approximately $12 million last year.

DEVELOPING CONTROL MEASURES FOR SPOTTED WING DROSOPHILA

Pest management changed for berry growers when the spotted wing drosophila arrived on the East Coast a few years ago. Adults lay eggs in immature fruit and larvae develop in still-ripening fruit, making it unmarketable.

Growers increased their insecticide sprays to fight off the pest, leading to concerns about pre-harvest treatment intervals and pesticide residue levels. Based on 2012 data from 12 Southeastern states, economic impacts from spotted wing drosophila in blueberries, caneberries and strawberries were between $45 and $55 million. Losses included damaged fruit as well as rejected shipments, with USDA inspectors rejecting entire shipments upon discovery of even one spotted wing larva or adult.

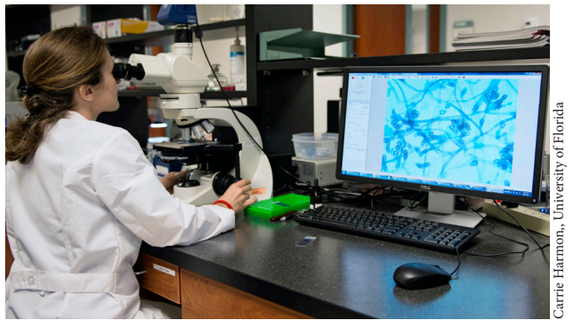
In 2013, a group of entomologists received RIPM funding and formed a work group of research and extension specialists to examine management options and test pesticide residue levels at optimum spray recommendations.

The group found that weekly rotations of current insecticides are sufficient to prevent infestation of blueberries (but not blackberries) and, when administered properly, the weekly applications did not exceed maximum pesticide residue levels for U.S. trading partners. The research also revealed that plant architecture for blackberries may impact infestation rate, leading to possible future recommendations for insecticide applications.

IMAGE DATABASES OF PLANT PESTS SUPPORTS IPM IN ALL SETTINGS

Many RIPM projects address a specific setting or pest – schools, or brown rot in peaches for instance. But RIPM-funded projects have also helped develop a broader infrastructure used to enhance IPM research, education and implementation in a variety of settings. Such is the case with several grants awarded to the Southern Plant Diagnostic Network and Center for Invasive Species and Ecosystem Health – commonly known as Bugwood.

Bugwood grants contributed to development, maintenance and enhancement of an extensive database of images that includes pests, plant symptoms, beneficial organisms and even microscopic views of plant disease pathogens.



Carrie Harmon, University of Florida

As of June 2015, the Bugwood database, accessible online at IPMimages.org, receives 12,000 views per day. The database contains 236,916 images on 22,288 subjects, by 2,341 photographers.

The Southern Plant Diagnostic Network used its grant to add images of pathogen morphology to Bugwood's image database, which is now the "WedMD" for plant pathogens. These image databases are used extensively by university researchers and educators, extension specialists, homeowners, consultants and agribusinesses including Home Depot and Scotts. Since June 2014, Bugwood received 9,212 requests to republish 45,464 images.

HELPING CATTLE PRODUCERS MONITOR HERDS FOR TICKS

Ticks are not only blood-sucking pests of humans and animals; they can also transmit pathogens resulting in serious diseases. That's why there have been several Southern region RIPM-funded projects to address tick management.

Four projects at Texas A&M focused on the Gulf Coast tick, an important pest of beef cattle and potential vector of a new disease called Heartwater, known to be in the Caribbean. The first project, in 2004, identified and characterized a pheromone that can be combined with insecticides in cattle ear tags for an "attract and destroy"

John Jackman, Texas A&M AgriLife Extension

strategy that could help ranchers manage the ticks and avoid $4 million in tick-related losses annually.

Two other projects created a new early detection method for tick infestations by analyzing cattle fecal material using near infra-red reflectance spectroscopy. Researchers found tick stress shows up as chemical differences in fecal material, allowing producers to distinguish between tick-infested and non-infested cattle. The scanning equipment necessary to use the method is now available, and producers using it can save time by making decisions for tick treatments and animal nutrition without gathering and inspecting cattle.

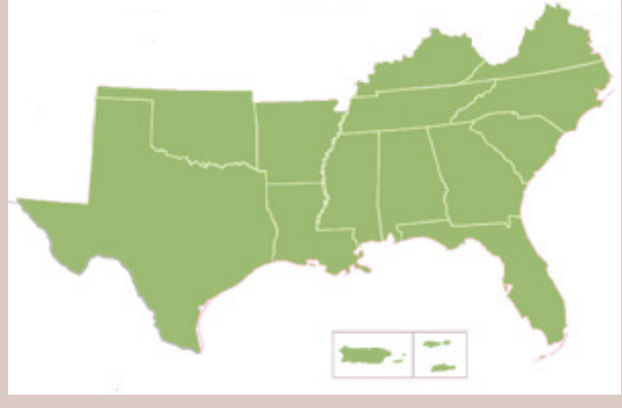
The final project is developing models to predict tick populations and risks to animal production. Tick population changes can be explained by trends in drought conditions, and by predicting population changes, producers can anticipate tick risks to make informed management decisions.

Southern Region

The Southern IPM Center managed the competition for the Southern Regional IPM grants from 2005 through 2013. In that period, requests for applications prioritized proposals that explicitly addressed the National IPM Road Map; that were linked to priorities identified by IPM stakeholders; that demonstrated potential to improve risk avoidance or mitigation in IPM; that were innovative; and that involved participation or likely benefit to multiple Southern states.

RIPM proposals funded in these years addressed important regional needs. For instance, three projects on cotton were led by faculty in Texas, Georgia and South Carolina – states ranked first, second and tenth in cotton acres. Multiple projects addressed IPM in peaches in South Carolina and Georgia, and others addressed IPM in rice, beef, swine and poultry – all important Southern crops and products.

www.sipmc.org



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August 2015

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2013-34103-21478.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.