



Southern
IPM
Center

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Southern IPM Center Annual Update

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Graduate Students added to recipients of “Friends of IPM Awards”

Sandra Wheeler literally sang her thanks to the audience as she received a Friends of Southern IPM Award this past April. Wheeler was one of eight recipients who received a 2013 Friends of Southern IPM Award, and one of the first two graduate students ever to receive an award from the program.

Wheeler, a masters student from Florida A&M University, and **Jacob Price**, a Ph.D. student from Texas Tech University bested 14 other nominees for the graduate student award. This year, SIPMC added two categories for graduate student awards: one for masters students and one for doctoral students. Each category received eight nominations, and an external award panel judged the nominations.

The Graduate Student award was added this year to reward excellent graduate students in IPM with special recognition and a sizeable honorarium. Previously, graduate students fell under the Future Leader category, but the few who were nominated could not compete against seasoned young assistant professors who had already led significant projects and published numerous journal articles.



Wheeler, who graduated in May, participated in a research project involving control of the small hive beetle, a serious pest of honeybees. Wheel-

er discovered a fungal strain of *Metarhizium anisopliae* 5860 that is highly toxic to the beetle. By using the fungus, beekeepers could reduce the doses of miticides and reduce the possibility of resistance. Wheeler received her award at the annual Association of 1890 Research Directors Symposium in April, surprising presenter Henry Fadamiro with a musical speech of her own.



Price, who will graduate next year with his Ph.D., is a senior research associate in Amarillo and a diagnostician for the Great Plains Diagnostic Network. His focus has been on the wheat curl mite, vector of wheat streak mosaic, a virus that fools producers into increasing irrigation because the symp-

toms resemble drought stress. Through testing, Price discovered optimal irrigation rates for plants stricken with the virus, saving growers an average of 28.6 million gallons of groundwater per year. He also discovered a cultivar that shows strong resistance to the virus, also promising significant cost savings for wheat producers. Price will receive his award next February at the Southern Division meeting of the American Phytopathological Society.

Seasoned professionals claimed an award in each category, with three awardees receiving their awards during the annual



Southeastern Branch of the Entomological Society of America meeting in March. **Jack Bachelier** and a team of entomologists from the region took the Bright Idea award from four other nominees in that category for a decision aid card that is used by 80% consultants. The card measures cotton boll size so that consultants and producers can choose bolls more effectively to test for stink bug damage. If used by growers in North Carolina alone, the card has the potential to save at least \$15 million in damage.

Ayanava Majumdar, who won the Future Leader award last year, returned to the Southeastern Branch meeting this year to claim the Pulling Together award for the

Friends of IPM (continued)



Alabama IPM Communicator newsletter. The IPM Communicator is an online weekly newsletter that is heavily used by Alabama farmers. Grower magazines

like Southeast Farm Press often disseminate the information to their readers. Growers who use the newsletter recommendations have saved at least 50% or more of their crop, and small farmers save between \$242 to \$591 per year by using the IPM recommendations.



Also from Auburn University, **Tim Reed** received the IPM Educator award during the Southeastern Branch meeting as well. An Extension entomologist, Reed cov-

ers row crops and turf IPM. In 2012, Reed conducted a grower survey that identified the most prevalent insect pests, as well as where they were located, helping Extension specialists and agents better target their efforts. The original purpose of the survey was to determine how prevalent the kudzu bug was. At that time, it was not a major pest, but his survey identified hot spots for researchers to watch closely, allowing growers to be more prepared for the pest when numbers began to multiply.

School IPM Coordinator **Dan Lisenko** received the IPM Implementer award in front of his district superintendent, the school board and an audience of parents and teachers during a school board meeting in April. Lisenko, who

manages the district IPM program in the Manatee, FL, school system began a school IPM program in a state that has no school IPM requirements. Backed by his supervisor and the Director of Maintenance and Operations, Lisenko has run a model IPM program that has been touted by

the EPA as one of the best in the country.



NC State University assistant professor **Steve Frank** earned the Future Leader award with his work on biological control and his

review on Banker Plant systems. While he was a graduate student, Frank participated in two projects that focused on biological control: one involved the installation of conservation strips at golf courses to increase predator abundance, and the other examined ecological interactions that influence biological control effectiveness. At NCSU he has done considerable research on the granulate ambrosia beetle and works closely with nursery growers to protect their stock from pests while reducing the use of pesticides. Frank received his award in September at the first faculty meeting of the year.

Longtime IPM friend **Harold Coble**, who is receiving the Lifetime Achievement award at this meeting, has been known by many as one of our IPM champions. Coble, who plans to retire in February from USDA, was a strong proponent of the IPM Centers and the first director of the Center for IPM at NC State University. He now works in the

USDA Office of Pest Management Policy and is a vocal member of IPM Voice. See the story on Coble's career on page 11.



SIPMC Funds 15 IPM Enhancement Grants

SIPMC funded 15 of 24 proposals. In addition to the timing of this year's RFA, we made other changes in the RFA and proposal process. Changes include (from the RFA):

- **Choice on Evaluation:** Ideally, every funded project would include a plan to measure its own impact. That can be problematic, however, with short-term, low-budget projects. Projects may fulfill evaluation requirements using either of two approaches or a combination of both.
 - All proposals must present proposed outputs.
 - All proposals must discuss potential outcomes and impacts.
 - All proposals must address one of the following, or a combination of both:
 - Measurement of project outcomes and/or impacts resulting from this project. For example, include a post-implementation survey of the changes in IPM practices among project participants to determine project impact on those practices.
 - Measurement of information (i.e. baseline data) contributing to the general body of knowledge related to evaluation of IPM in the issue/setting addressed. The result should be useful to future impact evaluation efforts. In other words, this impact evaluation work may be separated or unhinged from the project itself, and address instead the broader issue/setting. For example, include a survey of current IPM practices used by the growers involved in the proposed project.
- **Special Priorities for Seed, Capstone and WG Projects:** Based on results of a recent regional survey of extension priorities, five issues are identified as high priority for this program. We will fund as many as five projects, with no more than one funded project addressing each priority. Extension projects with potential to quickly enhance implementation of IPM are preferred in this category, but research and developmental projects will also be considered.

Each 2013 Special Priority proposal must also be constructed as a Seed, Capstone, or Working Group project type, with the same funding limit of \$30,000 per project.

Scoring priority will be given to projects based on criteria ... including potential for success; resource building, investment or utilization; impact evaluation component; appropriate budget; and project evaluation.

Proposals fulfill the "regional priority" criterion by virtue of addressing one of the 5 priorities. However, PDs are advised to address regional importance because projects that are not funded as a 2013 Special Priority project will still be in competition with all "non-special priority" projects.

2013 Special Priorities are:

- Herbicide resistant weed pests affecting important agronomic crops
- The insect pest *Megacopta cribraria*, known as the kudzu bug
- Stink bug pests in agronomic crops
- The insect pest Spotted Wing Drosophila (SWD), *Drosophila suzukii*
- Residential IPM, including management of bed bugs, termites, fire ants and other pests as well as general IPM principles and techniques
- **Public project web page:** We are considering a series of publically accessible project web pages separate from the current PPMS system that PDs could use to communicate with the public.

The following is a list, with short descriptions, of each of the 2013 IPM Enhancement projects:

A Dual Recombinant Vaccine for Brucellosis and Immunocontraception in Feral Swine, Nammalwar Sriranganathan (Virginia Tech) \$29,402

This innovative project investigates curbing populations of feral swine while also preventing them from transmitting brucellosis. Feral swine cause \$1.5 billion each year in crop and land damage, and they harbor *Brucella suis*, the bacterium that causes brucellosis, a deadly cattle disease. Dr. Sriranganathan will test a newly developed vaccine on mice.

IPM Enhancement Grants (continued)

A Low-cost, IPM Curriculum for the Public Schools and Municipalities, Janet Hurley (Texas A&M AgriLife Extension Service) \$30,000 (2013 Special Priority - residential)

School IPM coordinators and practitioners will benefit from this project that will make IPM materials more readily available at little or no cost via the Internet. Many school districts face the daunting challenge of establishing and maintaining an IPM program with little or no money to buy training materials for staff. This new IPM curriculum will coordinate websites, handbooks, fact sheets, workbooks, videos and pest ID guides into one self-directed training module for schools, municipalities and others.

Assessing the scope of an emerging threat: The insecticide resistant bait averse German cockroach, Jules Silverman & Coby Schal (North Carolina State University) \$30,000

Not only are German cockroaches capable of transmitting bacteria to food products, but they are also a prime source of allergens that can trigger asthma. Typically baits are used to control cockroaches, but for the last 20 years, cockroaches have evolved; some are resistant and avoiding the baits. This project will examine cockroaches with this "dual averse" characteristic, establish a profile, determine the scope of the population and suggest alternative controls.

Bed Bugs and Book Bags Prevention and Education Program, Rebecca Baldwin (University of Florida) \$28,961

Although they don't typically transmit disease, bed bugs are probably one of the most feared public health insect in the United States. In 2012, the Jacksonville Bed Bug Task Force created the Bed Bugs and Book Bags curriculum for third through fifth graders, and educators showed an overwhelming interest in the materials. Within the first three months of the curriculum's creation 194 people had downloaded the curriculum and indicated that they would impact over 19,000 people. Dr. Baldwin seeks to use funding for this project to complete pilot testing and evaluation of the curriculum.

Developing spotted wing drosophila (*Drosophila suzukii*) integrated pest management program in blueberry and strawberry crops: Monitoring, management and outreach, Oscar Liburd (University of Florida) \$29,895

Those packages of strawberries and blueberries that shoppers see in the grocery store in December and January may have come from Florida, the primary U.S. producer of winter strawberries and early-season blueberries. In 2009 Florida berry growers faced a new threat, the spotted wing drosophila, which deposits its eggs inside ripening fruit and renders it unmarketable. This project builds on previous research and extension activities with respect to management of SWD in Florida's berry crops, including SWD surveys for blueberry and strawberry growers, management option identification and farmer training.

eFly: Southern Spotted Wing Drosophila Working Group, Hannah Burrack (North Carolina State University) \$29,321 (2013 Special Priority - SWD)

Another project focusing on spotted wing drosophila (*Drosophila suzukii*) will formalize a southern SWD working group that began with funding from a SIPMC Critical Issues grant. The working group began in order to coordinate research and extension efforts in the states where SWD has been found. The group now wants to develop a web page that will communicate research breakthroughs and extension activities, and to continue the priority setting and impact statements that began during the first meeting.

Insecticide susceptibility and esterase activity in the redbanded stink bug, Raul Medina (Texas A&M AgriLife Research) \$29,925

Like stink bug pests of cotton, the redbanded stink bug (*Piezodorus guildinii*) has become the primary pest of soybeans in the Delta region, especially in Texas and Louisiana. Losses in 2011 were at least \$100 million in Louisiana and \$11.5 million in Texas. Growers now treat stink bugs with acephate, but as the pest requires more frequent applications, scientists fear resistance is starting. This project will test for resistance to current insecticides, determine methods of resistance monitoring and test possible alternative products for control.

IPM Enhancement Grants (continued)

Extent of Multiple Herbicide-Resistant Weeds and Predicting Risk of Further Herbicide Resistance in Georgia, William Vencill (University of Georgia) \$23,005 (2013 Special Priority - herbicide-resistant weeds)

Experts have identified 217 species of herbicide-resistant weeds worldwide. In the southeastern U.S. one of the primary herbicide resistant species is Palmer amaranth, which affects more than 2 million hectares of agricultural land in the South. While many scientists are studying ways to combat herbicide resistance for existing weeds, Dr. Vencill wants to predict what other weeds might become herbicide resistant. With this project he will survey 20 fields in Georgia and determine the likelihood of resistance in some of the most common weed species in Georgia agriculture.

Genetic structure of cotton stink bug parasitoids associated with different host plant species, Raul Medina (Texas A&M AgriLife Research) \$29,946 (2013 Special Priority - stink bugs)

Stink bug species are some of the primary pests of cotton, infesting millions of acres every year. Most cotton growers use chemical control against stink bugs, but the resulting eradication of natural enemies invites other pests to take the place of the stink bugs. This project will investigate the possibility of using parasitoids to control stink bugs and examine the host specificity of three species of sucking bug parasitoids.

IPM for Shrubs in Southeastern U.S. Nursery Production (Vol. I), a SNIPM Working Group Effort, Sarah White (Clemson University) \$29,983

This project involves compiling information for and publishing the first volume of a four volume series on IPM in southeastern shrubs. It will also involve a grower needs assessment, assess short term and long terms goals and develop priority projects. The working group previously compiled and published an I-book on deciduous trees.

Preliminary assessment of indigenous pecan germplasm for insect and pathogen resistance, Julio Bernal & Marvin Harris (Texas AgriLife) \$29,996

Pecan IPM in Texas and other states emphasizes direct control of nut-feeding pests while emphasizing tolerance of other pests. Researchers have begun work on host plant resistance to lessen both the intensity of damage and the need for sprays. In this project, Drs. Bernal and

Harris will evaluate pecan seedlings at the National Clonal Germplasm Repository for Pecans and Hickories for their resistance against various pest insects and diseases.

Strengthening Extension Leadership and Stakeholder Training on the *Megacopta cribraria* Invasion Front, Xing Ping Hu (Auburn University) \$30,000 (2013 Special Priority - kudzu bug)

Since its initial detection in Georgia in October 2009, the kudzu bug has become one of the most serious agricultural and residential pest of the Southeast. Researchers have already made several discoveries about the biology and ecology of the pest. Now Extension personnel and public stakeholders need training to learn the best ways to manage the pest using IPM methods. This project will develop a comprehensive educational program for state and regional leadership to develop educational materials for agricultural and urban stakeholders.

Sustainability in Turfgrass Systems: Assessment of New Strategies for Weed Control and Species Selection, Travis Gannon (NC State University) \$29,969

Most people expect turfgrass to be lush, green and uniform, but those who have to make sure it looks that way don't have an easy job. Weeds are the main pest problem for turfgrass. Typically landowners use herbicides to kill weeds, but repeated use breeds resistance. With this project, Dr. Gannon plans to compare non-pesticidal weed control options to synthetic herbicides.

Towards managing target spot, caused by *Corynespora cassiicola*, in cotton, Austin Hagan (Auburn University) \$30,000

In the past two years target spot has caused widespread defoliation in Alabama, Georgia, North Carolina, South Carolina, and Virginia. Because the disease is relatively new and until recently was localized to irrigated cotton in southwest Georgia, very little is known about the disease or its effective control. Lint decline is estimated at 5 percent for tolerant varieties, a percentage that would cost producers in Georgia and Alabama alone \$65 million. This project will examine the disease and its impact on cotton lint yield and quality, as well as fungicide options.

IPM Enhancement Grants (continued)

Integrated Weed Management Options for Southern Vegetable Production, Nathan Boyd (University of Florida) \$29,683

In light of the loss of methyl bromide, land-grant extension personnel have been working with southern vegetable growers on viable IPM alternatives. This project will evaluate new herbicide options for tomato growers and determine priorities in weed management during the crop cycle. Dr. Boyd and his team will compare different treatment options to see which ones maximize economic return and minimize environmental effects.

Assuring Adoption of Previous and New IPM Farm-scaping Practices, Robert Hochmuth (University of Florida) \$29,938

This project uses the University of Florida Living Extension IPM Field Laboratory to demonstrate IPM as a whole farm approach rather than specifically pest control. The Florida Farmscaping Working Group will characterize the types of farms most likely to adopt farmscaping practices, identify the challenges of farmscaping adoption, develop and deliver a farmscaping curriculum to farmers and target Extension agents with training.

Southeastern Scientists Use USDA Funding to Protect Tomato Crops from Tomato Leaf Curl Virus

Last year was one that many Georgia tomato growers won't easily forget, when whiteflies swarmed over their tomato fields and left a destructive virus to race through their crop. Now having discovered firsthand the consequences of being unprepared for tomato yellow leaf curl virus, growers are turning to Georgia scientists for solutions. Researchers at the University of Georgia are working to find out more about the insect that transmits the virus, as well as some solutions that will give growers a marketable crop.

After Georgia growers began finding tomato yellow leaf curl virus in their field several years ago, many have begun spraying every week to reduce the whitefly populations and prevent virus transmission. Unfortunately, says Dr. Rajagopalbabu Srinivasan, a research entomologist with the University of Georgia, spraying often reduces the whiteflies' natural enemies and increases the populations of whiteflies.



Credit: Dr. Rajagopalbabu Srinivasan

"Whiteflies have natural enemies, but the sprays are wiping them out," he says. "The whiteflies survive the sprays better than their natural enemies. Some whitefly populations are also developing resistance to commonly used insecticides such as imidacloprid."

Part of the solution, says Srinivasan, is to plant varieties that are resistant to the virus. Growers have had access to several resistant tomato varieties since the early 21st century, but most growers prefer not to grow them.

"Resistant varieties are grown on less than one-third of the tomato acreage in Florida," he says. "They don't produce the beautiful tomatoes of the susceptible varieties, and the shelf life isn't as long."

But a crop of tomatoes from a resistant variety is better than no crop from a susceptible variety, Srinivasan says. Every year, whitefly peaks coincide with the early tomato development, when the plants are most vulnerable to

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Tomato Leaf Curl Virus (continued)

infection. Once a few susceptible plants are infected, tomato yellow leaf curl virus can fill an entire field with stunted plants that produce no tomatoes. Even though growers spray insecticides, it takes one whitefly carrying the virus only a few minutes of feeding to infect a tomato plant.

Some growers have already planted resistant varieties but often grow them alongside susceptible varieties. Srinivasan wanted to know if that was a wise practice, or if resistant varieties may in fact harbor the virus and increase the chances that whiteflies would pick up the virus and transmit it to the susceptible plants.

So in 2010, he used funding from a Southern IPM Center IPM Enhancement grant to study how whiteflies interact with both resistant and susceptible varieties, if resistant varieties could harbor the virus, and if whiteflies would transmit the virus from the resistant to the susceptible varieties.

Not only did the resistant varieties become infected, but whiteflies that fed on infected resistant varieties could acquire the virus and transmit it to a nearby susceptible variety. Srinivasan concluded that growing the two varieties contiguous to each other may actually increase the chance of a yellow leaf curl virus epidemic. In addition, because infected resistant cultivars show no symptoms, growers would not realize the field was infected until susceptible cultivars were infected. No variety has been developed that is resistant to whitefly feeding.

The initial findings from the Enhancement grant landed him and his Georgia colleagues a larger multi-year USDA Agriculture and Food Research Initiative (AFRI) grant, adding cooperators from South Carolina and Florida. With the AFRI grant, he hopes to find growers optimal solutions that will allow them to have marketable yields of toma-



Resistant tomato variety (L) vs. susceptible tomato variety (R) Photo by R. Srinivasan

atoes that will be desirable to consumers.

To find those answers, he and his colleagues are studying whiteflies more intensely, to understand what attracts them to plants and to discover other plants, such as weeds, that may be sources of whitefly populations and/or the virus. They also plan to test several methods of whitefly control, including cultural practices like reflective mulch and periods of fallowness.

The researchers will also compare resistant and susceptible varieties for fruit quality, ripening and shelf life. Some of the newly-developed resistant varieties seem to be more promising in terms of marketable quality, so Srinivasan hopes growers may be more willing to grow them without adding susceptible varieties to the field.

Their analyses will ultimately result in a decision support website that will allow growers to plug in several variables to find out what varieties they should plant.

“For instance, they can choose an insecticide and a mulch and include their history of leaf curl virus, and see what options they have,” Srinivasan says. “The site will tell them how much risk they’ll have with the options they choose and how much they would gain or lose by planting one variety over another.”

In a given year, grower could save thousands of dollars per acre by using a combination of cultural controls and resistant cultivars with significant reductions in pesticide use. Fewer pesticides would mean more whitefly natural enemies, leading to fewer whiteflies and a reduced possibility of infection.

For growers who have already lost a crop to yellow leaf curl virus, the website won’t come a moment too soon.

FITT Facilitates Working Groups, Provides Mapping for Kudzu Bug

Associate Director Joe LaForest, who has been leading the Facilitation of Innovation Through Technology (FITT) Initiative, has made communication tools available for working group members to use platforms to give them more communication options, develop a common database for exchange of information, and provide new content delivery/data visualization options for occurrence records and trapping data of certain species.

LaForest has been assisting a working group funded by the Northeastern IPM Center in creating a database for a system that will help landowners and municipalities select plants ideally suited to the planting space. The "Find-a-Plant" database will include choices for soil characteristics and include additional features such as pest resistance and drought tolerance. The database will also include warnings about plants that may become invasive. The group is currently identifying sources of existing information and have devised a database schema centered on plant taxonomy.

FITT has provided communication tools via an online platform called "Basecamp" for working groups to share information. The Small Farms Working Group has been using Basecamp for their discussions of small farms definitions and crop choice for IPM manuals, and members of the national SWD Coordination project have been holding national discussions on SWD management and locations.

The eFly group also used FITT to develop county-level mapping capacity to track SWD from the beginning of trapping season. The trapping program extends from Florida to Maine and as far west as Arkansas. FITT is also working with partners in the western region to aggregate observation data from their trapping efforts to provide national distribution maps.

Researchers and extension personnel working on kudzu bug are using the kudzubug.org website created for the Megacopta working group. The site features the most current distribution of the pest, as well as a reporting tool that citizen scientists and Extension personnel can use to report sightings of kudzu bug. Reporters must submit an image so that the sighting can be verified. So far 479 reports are included in the system; 251 of those have occurred since the reporting system was included online last year. The system has served both to identify the leading edge of the infestation, and to provide notification of when the insect became active in the season. The maps generated from the system can be embedded in other websites or copied and pasted into Powerpoint presentations. In the past year, the site has received 3,061 visits from 2,204 unique visitors.



kudzu bug on soybean
Photo credit: Brad Fritz

Small Farms Working Group Meets for Second Time

Members of the Southern Region Small Farms Working Group (SFWG) hope to collaborate on two projects this coming year: a series of IPM handouts for specific specialty crops and a map of small farms in the southern region. SFWG includes over 30 IPM specialists and small farm practitioners from 1862 and 1890 Land-Grant universities and private consultants in the 15 southern states/territories working to promote IPM adoption by small-holder farmers in the region.

During a day-long meeting held in August in conjunction with the Florida Small Farms and Alternative Enterprises Conference in Kissimmee, Florida, members shared their experiences of working on pest issues with farmers of small-holder farms. In many cases, farmers lacked knowledge about IPM or could not afford integrated methods because of expense or lack of manpower.

Few federal programs are available to assist small-holder farms with IPM, and many farmers cannot afford a crop consultant. Faced with attending to pest problems on their own, many small-holder farmers use a single meth-

od or do nothing and lose their crop. To assist farmers on a regional scale, the working group plans to develop IPM guides for a selection of crops. The group is currently discussing which crops will have guides.

Several members mentioned that most consumers do not understand where their food comes from. To help consumers make the connection between small farms and the food they buy, the group plans to develop an online, interactive map of small farms and farmers' markets in the southern region. When a user clicks on a farm icon, he or she will see information about how that farmer grows the crops and how pests are managed on the farm.

However, to decide which farms to include in the map, members agreed that the definition of small farms needs to be more explicit than the USDA definition, which is fairly broad and can include both small farms and some larger farms. A committee is currently crafting a working definition of small farms.

The group plans to meet again next year.

Two New Positions in the Works

SIPMC is excited to announce two new positions that will be filled in the next year. The staff members will be working with the web site and with our Regulatory Information Network to make it easier for our regulatory partners to find information and to facilitate communication among the Network.

Programmer (Applications Analyst)

SIPMC is in the process of hiring a new Applications Analyst to create a new searchable database that will allow users to use keywords to search for information in the Crop Profiles and Pest Management Strategic Plans. Currently, Crop Profiles and Pest Management Strategic Plans are organized by crop or state. Once a user opens a document, he or she can search for information. The data-

base will not only aid users, but it will also help regulatory personnel update information about pesticides and other specific data without having to generate an entire new crop profile or PMSP.

Program Specialist

The Program Specialist will manage the Crop Profile and Pest Management Strategic Plans databases and will move archived content from the existing CP and PMSP databases into the new component-level database as it is developed. The Program Specialist will also facilitate coordination of the Southern IPM Center's Regulatory Information Network.

SIPMC Presents Longtime IPM Friend Harold Coble with Friends of IPM Lifetime Achievement Award



Dr. Harold Coble first realized the need for economic thresholds in weeds when he was explaining the use of Basagran to a group of soybean growers.

"I told them how to use it, how much to use, and when they would need to use it," Coble says.

Then one grower in the back of the room raised his hand and asked, "So when do we use this?"

Slightly annoyed, Coble started explaining the process again when the grower said:

"No. I mean when do I have enough weeds in my field to be able to afford this product?"

At that time there were no economic thresholds for weeds, and Coble had no answer for him. However, the question intrigued him so much that he began a quest to find the answer to the grower's question, not just for that product, but also for products labeled for weeds in soybeans. In 1976, he became involved in the Adkisson project, a USDA-funded Research and Extension project designed to test, refine and evaluate ways to reduce the use of pesticides while still maintaining crop quality and yield. During the first of two projects, Coble delivered research results about IPM to farmers. In 1985, the project culminated with an article on weed control in agricultural systems.

Three years later, Coble and fellow NCSU scientist Gail Wilkerson collaborated on a weed control decision support system, named HERB. HERB was the first online system that allowed growers to input a set of variables and get a control recommendation in return. The tool became so popular that other Extension specialists adapted it for their states.

Coble's career took another turn during a meeting in the early 1990s between representatives of the NC State Weed Science faculty and BASF. As Centers for Excellence were becoming more prominent, a BASF representative asked if the University could develop a Center of Excellence for Weed Science. Coble became the likely candidate to research the idea, so he spoke to Ron Kuhr, then director of research for the College of Agriculture and Life Sciences at NCSU. Rather than simply giving a green light, Kuhr encouraged Coble to make the Center multi-disciplinary and instead create a Center for Integrated Pest Management.

With a plan in mind, Coble had just one more daunting task: to find money to start the Center. The National Science Foundation sometimes granted start-up money to scientific centers, but it was very particular about the mission of the center. Most of the centers that had received money focused on the hard sciences, like engineering or food science. So when Coble broached the idea with the director of the NSF Industry/University Cooperative Research Centers program he wasn't surprised to hear that IPM did not fit in NSF's model.

Fortunately for Coble, USDA was beginning to focus more attention on IPM that year, so within a few days, that director called Coble back to accept his proposal. With \$50,000 start-up money from the NSF, Coble traveled to several states, visiting private companies and signed up six companies as the Center's first sponsors, at \$50,000 each. The new Center for IPM would support IPM research on the national level.

Once the Center was up and running, Coble agreed to manage it for a year. A year and a half later, College administration convinced entomologist Dr. Ron Stinner to be the new director, and Coble stepped down and resumed his duties as a weed scientist.

It wasn't long, however, before Coble received another leadership offer, this time from the USDA Cooperative State Research, Education and Extension Service (CS-REES) to be the national IPM Coordinator. As national IPM Coordinator, Coble chaired the USDA IPM Coordinating Committee (which eventually became the Federal IPM

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Harold Coble (continued)

Coordinating Committee) and met with scientists from USDA and other agencies to try to coordinate IPM efforts among agencies. Keith Pitts, Special Assistant to the Secretary on Domestic Policy, suggested putting together a proposal for IPM grants, to garner more support for IPM. Coble wrote up concept papers for two new grants: Crops and Risk and the Risk Avoidance Mitigation Program. Both received funding and became long-term programs that would help researchers find new pest management tools to replace chemical pesticides that had been cancelled or were beginning to lose effectiveness due to resistance.

Shortly after the passage of the Food Quality Protection Act in 1996, USDA developed an IPM initiative, promising that by the year 2000, 75 percent of U.S. cropland would be farmed using IPM. Concerned that the projection may have been too optimistic, USDA directors asked Coble to explain how the agency would measure the number of acres farmed using IPM. So Coble came up with a definition of the steps needed for effective IPM: Prevention, Avoidance, Mitigation and Suppression (PAMS). Farmers had to use three of the four tactics to qualify as an IPM implementer. A subsequent survey revealed that 74 percent of acres were farmed under IPM based on the PAMS definition.

However, the General Accounting Office was not convinced. In 1998, requested by Congress, they did their own study and published a report that criticized both the federal coordination as well as the national implementation of IPM. Coble would later be asked to respond to the report.

Coble's next project was to develop a concept about how to coordinate IPM efforts across the country. Some USDA staff suggested developing a model of IPM Centers, based on the North Carolina Center for IPM. Coble proposed creating 12 IPM Centers, each in one of EPA's regions, at the tune of \$36 million. In the year 2000, CS-REES decided to repurpose \$4 million in funding for the National Pesticide Impact Assessment Program into four regional IPM Centers, at Pennsylvania State University, Michigan State University, the University of Florida and the University of California at Davis.

"The reality of the Centers is much better than the idea ever was," says Coble. "They have evolved and really taken on the vision of what we thought the Centers should be."

In 1999, Coble left Washington and returned to NC State. Shortly after he had moved his furniture from his townhouse in Alexandria back to his home in Raleigh, the director of the USDA Office of Pest Management Policy (OPMP) called to offer him a job with the agency. Coble refused to move back to DC but said he would take the job if he could remain in Raleigh. The Secretary of Agriculture agreed to his terms.

Coble's first assignment was to write a letter responding to the report that resulted from the GAO's IPM evaluation in 1998. As he wrote the letter, explaining that IPM needed to be a coordinated effort, he realized that the agency needed a group that would coordinate IPM efforts across all government agencies and a "roadmap" defining the purposes of IPM and the areas that it covered. The Federal IPM Coordinating Committee (FIPMCC), which began in 2004, approved the IPM Roadmap soon after they convened, a document which is still frequently cited by researchers and project directors and is used as a measure to evaluate grant proposals.

As Coble prepares to retire in January 2014, he leaves behind a legacy of grant programs, IPM definitions, an international Center for IPM and four regional IPM Centers that still support IPM research and extension in the country. His weed control decision support system is used across the country and taught in university IPM courses as a weed IPM tool. Researchers and commodity groups are fighting to restore funding to the Crops at Risk and Risk Avoidance Mitigation programs, both of which were defunded in 2011.

"If I can get people together and promote collaboration, that's what I want," says Coble. "I've learned the value of working across agencies and with people with different skill sets. You should never surround yourself with people that have your skill sets. You need someone to throw darts at what you think."