ALABAMA INTEGRATED PEST MANAGEMENT PROGRAM 1998 ANNUAL REPORT

IPM

Integrated Pest Management

ALABAMA

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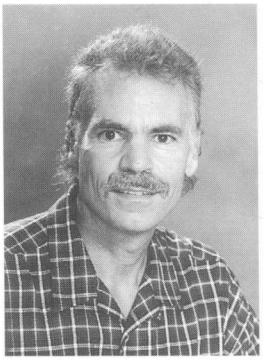
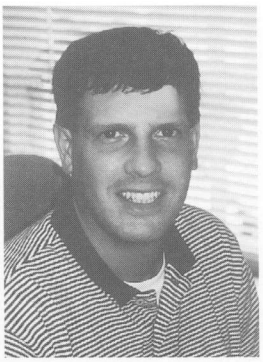
Integrated Pest Management 1998 Annual Report



Geoff Zehnder, IPM Coordinator



Mark Rumph, IPM Program Assistant

Welcome, and thank you for your interest in the IPM Alabama Program! We are excited about the integrated pest management (IPM) programs and projects that took place in our state during the past year. Our primary goals have beento increase public awareness of the benefits of IPM and to provide the public with easy access to information on IPM to assist with decision-making. Achieving these goals will enable our clientele to increase their levels of implementation and long-term adoption of environmentally sound pest management practices. During 1998, program participants made significant progress towardsthese goals, and we also exploited recent advances in information technology to make it easier for people in the state to access information on IPM.

While most program areas expanded during 1998, several areas lost key personnel either to retirement or to other jobs. Dr. Faith Oi, our Extension urban entomologist, moved to the USDA-ARS in Gainesville, Florida, where she will continue her work with termites and fire ants. Though her expertise with the urban programs here in Alabama will be greatly missed, we congratulate her on her new job and hope to continue our interactions with Faith. Dr. Patricia Cobb, our Extension turf and landscape entomologist, recently retired after more than twenty years of work in her field. Her extensive local and national involvement with golf course and turf management leaves a great legacy to be admired. She will continue to work as a guest lecturer at universities across the country and will stay on as a consultant with the USGA, culminating in overseeing course preparation for the Ryder Cup matches in 1999 in Baldarama, Spain.

Despite these changes in personnel, our outlook for 1999 is positive. We hope that the urban and turf IPM positions can be replaced so that we can continue to provide expertise in these areas. We are also positive that the Alabama Cooperative Extension System will continue to support the IPM Alabama Program to enable us to continue and expand successful programs, such as the IPM mini-grants program and website development, and to move into new areas as needed. We hope that you find the 1998 Annual Report interesting and informative. Please feel free to call or e-mail if you would like additional information about the IPM Alabama Program.

Sincerely,

Mark A. Rumph
IPM Program Assistant

Geoff Zehnder
IPM Coordinator

IPM ALABAMA WEBSITE – http://www.acesag.auburn.edu/department/ipm

The IPM Alabama Program continued to expand their internet presence in 1998, with a goal of providing timely, unbiased pest management information to the public. Citizens from around the world accessed the website more than 10,000 times during the year. Most of the inquiries came from Alabama, but we received questions from as far away as Africa and South America.

The website currently contains more than 500 pest management documents covering hundreds of subjects. In 1999, the IPM Alabama Program will add a great deal of urban IPM information, a common request from internet viewers.

IPM ALABAMA WEEKLY PEST UPDATE SYSTEM

In 1998, the IPM Alabama Program initiated an Electronic Pest Update System. The Pest Update System was developed as one of the Alabama Cooperative Extension System Team Plans, and involves a diversity of participants from all over the state, including extension specialists, county agents, state agency personnel, and agricultural consultants. The Pest Update System is truly a team effort, in that each week during the growing season, the participants send in email reports on pest and crop conditions in their area. The weekly reports are compiled in the IPM Alabama Program office and released online in newsletter format to provide a statewide picture of pest and crop conditions throughout the state. The 50 participants received the weekly Pest Update Newsletter by email or on the IPM Alabama website, and could then forward the information to their clients by email or by making print copies of the Newsletter. We hope to expand the Pest Update System by recruiting a greater number of participants for the 1999 season.

If you are interested in participating or receiving the information this year, please e-mail Mark Rumph at mrumph@acesag.auburn.edu with your request.

PUBLICATIONS AND RELEASES

Periodically, the IPM Alabama Program develops and distributes publications about timely topics that might arise within the IPM field. In 1998, a "Garden Wheel" providing information to homeowners about proper gardening practices was produced in conjunction with a non-profit environmental education group, Legacy, Inc. Throughout the year specialists also provided information for press releases concerning many pest management issues such as the 13-year cicada emergence last spring.

The program also publishes a quarterly newsletter, the IPM Alabama News. The purpose of the newsletter is to provide timely updates about current IPM projects. The newsletter is distributed to university administrators, state decision makers, and other state IPM programs.

ALABAMA A&M AND AUBURN UNIVERSITIES

Extension SYSTEM

ANR-1126

IPM Tactics for On-Farm Stored Grain

All the expense and effort of making a crop can be wasted if not enough attention is paid to storage. The key to storing grain successfully is to make storage conditions unfavorable for the survival of stored-grain insects and molds. The following steps are designed to reduce the initial number of insects in the bin, slow the development of any remaining insects, and apply corrective measures to reduce insect populations if necessary. Following these steps will also greatly reduce stored-grain molds and associated mycotoxins. More information on molds and mycotoxins is found in the last section of this publication.

Figure 1. Good sanitation can prevent many insect infestations.

Figure 2. Seal cracks and crevices to keep insects out.

Figure 3. Treat the empty bin with an approved insecticide.

1. Clean the storage bin thoroughly to eliminate starter colonies of insects (Figure 1). Every few years, remove the bin floor to clean underneath it, or fumigate to kill insects hiding beneath the floor. Don't forget the auger pit.

2. Seal any gaps or holes in the sides of the bin, using caulk or polyurethane foam (Figure 2). Have someone temporarily close the grain hatch so you can see if there is any light shining in through holes.

3. Apply an IPM-approved insecticide on the floors and sides of bins to eliminate insects hiding in cracks and crevices and to create a first line of defense against any insects that do find their way into the bin (Figure 3).

Table 1. Recommended Maximum Moisture Content for Grain in Aerated Storage Conditions

Crop	Planned storage time before marketing		
	6 months	6 to 12 months	more than 1 year
Corn and sorghum	14%	13%	12%
Soybeans	13%	12%	11%
Small grains	12%	11%	10%
Edible beans	16%	15%	14%

*Decrease each moisture content percentage by 1 percent if storing grain without aeration.

Visit our Web site at: www.acesag.auburn.edu

COTTON IPM PROGRAM

Team Members – Ron H. Smith, Barry Freeman, and Ron Weeks. Also included are 55 County Cooperative Extension Agents and 18 Private Consultants.

Insecticide resistance, eradication of an important pest (the bollweevil) and the introduction of genetically altered varieties have all significantly altered the economic pest situation in Alabama. In response to these changes, scouting techniques, threshold levels and insecticide chemistries have evolved to meet the new developments in cotton IPM in Alabama. The focus of the cotton IPM program has been to provide growers with the best information to base their pest management decisions in this evolving scenario.

In 1998, program members conducted cotton scouting short courses, grower educational meetings, Experiment station field days, and field/test demonstrations. Team members also participated in regional bacillus thuringiensis (Bt) resistance monitoring programs, developed a new cotton scout manual with modified techniques geared for Bt cotton, and created a new tool, the "Guide to Improved Control of Pyrethroid Resistant Tobacco Budworm on Conventional Varieties." Information was collected throughout the season on insect populations and made available via e-mail and the internet, as well as on a toll free "hotline" to alert growers of emerging conditions and IPM actions for managing those developments.

During the 1998 season, the average grower only made 1.5 insecticide applications, less than 25% of the historical average. Reasons behind the decline in chemical insecticide use include: over 60% of acreage planted to Bt varieties, over 80% of acreage monitored weekly for insects, an increased utilization of beneficial insects in cotton IPM, and an increased utilization of reduced tillage in cotton production.

SUCCESS STORY – Following the elimination of the bollweevil through eradication, Pickens County cotton producer, Hugh Summerville, has produced cotton for three consecutive seasons without making a single foliar insecticide application on his 500 acre farm. Mr. Summerville utilizes field monitoring, increased utilization of beneficial insects and realistic thresholds to take advantage of advances in cotton IPM. Mr. Summerville was honored in January of 1995 as one of four growers nationally who have blended cutting-edge techniques with a concern for the environment.

FORAGES AND SMALL GRAINS IPM PROGRAM

Team Members - Kathy Flanders, Donald Ball, Paul Mask, Mike Patterson, John Everest, Jerry Crews, and William Gazaway

The Forages and Small Grains IPM Team coordinated several projects in 1998 including: biological control of cereal leaf beetle and musk thistle, establishment of on-farm precision agriculture and long-term fire ant management demonstrations, surveys for aphid vectors of barley yellow dwarf virus, development of IPM tools for detecting insects in soil, and a train-the-trainer education workshop on stored grain IPM.

Soil insects continue to be a problem pest in pastures, and the team made progress this year in their work to develop new tools for detection. Sounds recorded with a microphone placed in the soil are being analyzed to see if there is a correlation between particular sounds and insect infestation. This will help farmers to identify areas of infestation without laborious soil sampling.

Cereal leaf beetle continues to be a sporadic pest of wheat, and research in 1998 focused on determining the relationship between yield loss and cereal leaf beetle infestation. This study will result in recommendations that will help growers to determine when treatment for cereal leaf beetle is necessary. Another project is being done to evaluate the effectiveness of parasitic wasps for biological control of cereal leaf beetle. In 1998 team members released the stingless wasps in fields with a high risk of cereal leaf beetle infestation. Sampling this spring will determine if the wasp biocontrol agents can effectively suppress cereal leaf beetle populations.

The aphid-transmitted barley yellow dwarf virus (BYDV) also continues to remain a serious threat to Alabama's small grain producers. A survey to identify the species of aphid that vector BYDV was conducted using an aphid suction trap. The Forage and Small Grain IPM Team also interacted with other researchers from Auburn University, the Florida Division of Plant Industry, the University of Georgia, the University of Kentucky, Virginia Tech, and Cornell University to obtain grant funds to develop a research data base on BYDV epidemiology.

A new biotype of Hessian fly was discovered in Alabama wheat in 1996-1997, and team members assisted USDA researchers in a survey to identify resistant biotypes.

Biotype "L," now detected in the northern half of the state, and the western third of the state, feeds on varieties of wheat that are resistant to other Hessian fly biotypes. The team increased educational efforts to inform growers of alternative management strategies for the resistant Hessian fly biotype.

Over the past five years, Alabama and Georgia wheat researchers have met jointly at least twice each year to plan and evaluate wheat research programs. As a result, cooperative programs are common and efforts are not duplicated but instead are complementary. The team also worked this year to form the Southeastern Wheat Alliance, composed of millers, bakers, seed and supply dealers, farmers, and researchers. Wheat IPM is one component of this larger project.

During 1998, Alabama cooperated with Georgia to conduct a Stored Grain IPM Workshop. Workshop attendees, a mix of county agents and growers, participated in hands-on sessions on Stored Grain IPM techniques. This project was supported by a grant from the Sustainable Agriculture Research and Education (SARE) Train-the-Trainer program.

As a part of the Alabama Fire Ant Management Project, experimental biological control agents were released in three Alabama pastures in 1998. The two biocontrol agents examined were a predaceous phorid fly and a disease-causing microsporidium. Researchers established demonstration projects with these agents on a cattle ranch to evaluate their effectiveness and cost. .

During 1998 the Team presented information on IPM through a number of venues. County, multi-county, and statewide meetings were used to communicate information on precision agriculture, weed control in grain, cultural practices for economic grain and soybean production, sustainable fertility practices, and economic analysis. Approximately 600 people attended these meetings. On-farm demonstration projects were also conducted at various sites across the state. Team members collaborated with many agencies, including NASA, on their projects and efforts to educate growers and the public

SUCCESS STORY – Cereal leaf beetles can be a serious pest of wheat. In many cases, however, farmers apply insecticides for control when the infestation levels are below treatment thresholds (the level at which the cost of insecticide application is justified to prevent economic loss). This happens because cereal leaf beetle feeding is highly visible on the plants, even though the level of damage may not result in loss of yield.

A series of on-farm demonstrations were planned at the time when cereal leaf beetle damage occurred to show farmers different levels of feeding damage to wheat. At the time of the demonstrations, most of the farmers had not yet applied insecticide, but they had made a decision to treat based the presence of feeding damage. As a result of the demonstrations, the farmers became acquainted with different levels of cereal leaf beetle feeding damage, and to determine the levels that justify spray treatment (treatment thresholds). In Morgan County, where the demonstrations were conducted, growers participating in the program saved $10,000 in insecticide costs, in addition to reducing the negative impact of the insecticide sprays on the environment.

FOREST IPM PROGRAM

Team Members – Wayne Brewer and Scott Enebak

This was a challenging year in forest pest management due to another year of extreme heat and drought. Insect and disease problems in trees and other forest vegetation were more severe because of the drought stress brought on by hot and dry conditions in 1998. Early in the year, broods of the 13-year* cicada emerged throughout Alabama resulting in a deluge of telephone calls and inquiries to county agents and pest management specialists. Even though the cicada is only a minor pest, the spectacle that they cause due to their large numbers and the noise they produce prompted many citizens to perceive them as a major problem.

As the summer wore on, problems associated with insect damage on weakened and stressed trees became apparent in both rural and urban areas. The outbreak of the southern pine beetle reached epidemic proportions in many counties across the state, and various other bark beetles further damaged or killed weakened trees. Nantucket pine tip moths attacked young pine plantations and Christmas tree farms throughout the state with as many as five generations produced throughout the year. Insect damage provided entry sites for pathogens; therefore diseases became a major factor in all types of trees this year. Many trees were lost, particularly in urban areas where groundcover and water was scarce.

Research continued in the forest IPM program to address insect pests and disease. A main focus area this year continued to be management of the Nantucket pine tip moth. Researchers are working to develop management strategies for this pest that affects newly planted pines in commercial plantations, Christmas trees and landscape trees around the state. Work is also continuing on the development of alternatives to the fumigant methyl bromide for control of soil-borne diseases in forest tree nurseries. Results from 1998 research by School of Forestry team members have shown that plant growth-promoting rhizobacteria may be a practical alternative to soil fumigation because these naturally occurring soil bacteria can induce plant resistance to disease and also stimulate seedling growth (see IPM mini-grant report on this project).

* Thirteen year cicada

PEANUT IPM PROGRAM

Team Members: Ron Weeks, Dallas Hartzog, Austin Hagan, and John Everest.

Activities during 1998 in peanut IPM continued to focus on tools to help peanut farmers survive the current economic downturn in the peanut industry. Alabama peanut growers planted 196,000 acres of peanuts during the year, and current estimates for the state yield average are for 2,000 pounds per acre. Extraordinary, severe weather was also a limiting production factor in the 1998-growing season. A mid-summer drought and two fall hurricanes contributed significantly to the lower-than-expected yields.

Adding to the unfavorable growing conditions, insect pest populations were significantly higher in 1998 than in normal years. Peanut growers made an average of three foliar insecticide sprays caterpillar pests. The fall armyworm was one of the major pests in this group. Damage from lesser cornstalk borer, a soil-dwelling caterpillar, was also severe due to the hot, dry weather in May and June. Growers spent an average of forty-five dollars per acre more in pest control in 1998 because of these unusually high pest populations.

Specialists on the Peanut IPM Team conducted two scout training sessions in 1998 with 105 clientele trained in peanut IPM techniques and pest identification. On-farm IPM tours were also conducted in Geneva, Covington and Coffee counties to assist growers and scouts with mid-summer pest identification and management. At the Field Crops Day held at the Wiregrass Experiment Station in Headland, over 350 growers, pest managers and industry representatives toured peanut IPM plots that highlighted the use of resistant peanut cultivars, tillage practices and predictive pest models for managing major peanut insect and disease pests.

A total of 11 Wiregrass-area peanut grower meetings were organized to provide approximately 480 peanut growers with the most recent results of peanut IPM research. Specifically, the research areas addressed included information on tomato spotted wilt virus (TSWV) management using multiple tactics of cultivar selection, planting date manipulation, seeding rate, and insecticide application. Data was also presented from studies showing reduced TSWV levels in no-till peanuts compared to conventionally planted peanuts and how no-till production could be incorporated into an overall TSWV management program.

SUCCESS STORY – In 1986, Tomato Spotted Wilt Virus (TSWV) was first identified on peanuts in Alabama. Since then, TSWV infection levels have increased such that in 1997, peanut fields commonly incurred infection rates of around 25 to 30 percent. Because no single management tool can provide control, research and extension efforts in Alabama have focused on a multi-disciplinary management system to minimize losses from TSWV. In 1998, Peanut IPM Team specialists conducted grower meetings in the 12 major peanut growing counties. A monthly newspaper column in the Alabama Peanut Producer Association (APPA), "Peanut News" was used to provide the latest recommendations for management of TSWV during 1998. In addition, a monthly agricultural television program on WTVY Channel 4 in Dothan, "The Noon Gene Ragan Show," was also used to alert growers to the TSWV management system. The components of the TSWV management system included planting resistant peanut cultivars, establishing a uniform vigorous plant population of at least four plants per row foot, planting in a time window of May 1 through May 10 when soils are warm enough to ensure good plant stands, and use of phorate insecticide for thrips control (thrips are vectors of TSWV).

A majority of Alabama peanut growers implemented these strategies, and as a result they experienced a significant reduction in TSWV incidence in 1998 compared with previous years; less than 5 percent infection rates compared with 20 to 25 percent last year. Based on yield estimates derived from small plot research studies, this level of TSWV reduction could result in yield increases of 300 to 500 pounds of peanuts per acre, or an estimated 90 to 150 dollars per acre increase.

TREE FRUIT AND NUT IPM

Team Leaders: John McVay, Ed Sikora, Arlie Powell, Robert Boozer, Bill Goff, and Wheeler Foshee

In 1998, the Tree Fruit and Nut (TFN) IPM Program focused efforts in pecan, apple and peach pest management. Members of the program worked closely with the Alabama Pecan Growers Association and the Alabama Fruit and Vegetable Growers Association to promote IPM use through various educational programs, including on-farm demonstrations, field days, and newsletters. The

TFN IPM Program is centered on the concept of cost efficiency and pest control optimization. In-depth IPM training is provided for farmers, scouts, consultants, and industry personnel. IPM manuals, report forms and other publications are made available to all participants. In addition, on-farm field demonstrations are conducted to enhance the IPM informational support base. Program efforts involve a team approach that includes entomologists, horticulturists, weed scientists, plant pathologists, pesticide education specialists and county agents. Up-to-date information concerning pest populations and trends is provided throughout the season.

TFN IPM program personnel were involved in the development of a "1998 Integrated Orchard Management Guide for Commercial Apples in the Southeast," an award-winning publication that has become the "Bible" for apple IPM in the southern region. Another very popular resource, The Alabama Pecan Pest Management Hotline, an 800 number service established in 1997, was expanded to include information on peach and apple pests and their management. Program specialists also worked closely with the agricultural industry to develop improved IPM techniques and strategies for tree fruit and nut crops. Total industry funding for specific projects was in excess of $100,000.

SUCCESS STORY – Pecans are produced on 50,000 acres in Alabama with an additional 5-10,000 acres of non-bearing orchards maintained. Production costs range from $300 to $500 per acre depending on cultivars and practices. The cost of pest management can total 50% of all production costs. The dynamics of the system demand that management decisions be made on a daily basis from budbreak until harvest. Losses of effective insecticides through product re-registration or pest resistance have negatively affected management efforts. Therefore, the continued development of effective IPM strategies is critical to provide adequate levels of crop protection without increasing costs. In 1998, pest problems were considered moderate and conditions were conducive to disease development throughout the season. As in previous years, TFN IPM recommendations promoted proper and timely application of fungicides and herbicides. Scouting revealed that insect pressure was moderate during the late season, which allowed for greater flexibility in management. IPM recommendations included preservation of beneficial arthropods where possible for natural control of aphids and mites. Surveys indicate that 90% of TFN acreage is monitored for pest infestations and 80% are treated according to IPM guidelines. Growers using IPM methods made an average of seven fungicide and four insecticide applications during the 1998 season. This is a reduction of six insecticide and five fungicide applications when compared with growers not using IPM practices. Orchard floor management costs for IPM growers remained stable. The cost savings to growers adopting IPM averaged $132.00 per acre for a total savings of $5.28 million to the TFN industry. Crop size and quality produced by IPM growers were not negatively affected by the reduced pesticide applications.

VEGETABLE IPM PROGRAM

Team Members – E. Sikora, G. Zehnder, J. Murphy, and J. Kemble

Vegetable production in Alabama is highly diverse with over 20 different crops grown throughout the state. The Auburn University Vegetable Task Force, organized by Dr. Kemble in 1994, serves as a Vegetable IPM working group for the state. The vegetable IPM program has many focus areas including: development and demonstration of low chemical input production systems, development and evaluation of biological control agents, and deployment of pest monitoring and management programs. IPM projects were conducted in many vegetable crops, with tomatoes and Irish potatoes as main focus areas in 1998. Tomato best management practices for diseases, insect pests, weeds, and fertilizer were demonstrated and validated for a second year on south Alabama tomato farms with grower cooperators. The cornerstone of the tomato IPM program is using knowledge of existing pest and crop conditions, through field scouting and weather monitoring stations, to determine if and when pesticides are needed. The IPM program saved cooperating growers approximately 30-40% in pesticide inputs without any reduction in fruit quality or yield. An Alabama Tomato IPM handbook is being developed that will contain information on all of the recommended IPM practices and tips for tomato disease, insect and weed identification.

The BLITECAST weather-based spray advisory program for late blight control in Irish potatoes was made available in 1998 to most of the potato production areas in the state. Like the TOMCAST program, BLITECAST advises growers when fungicide applications are needed based on the potential for development of disease. BLITECAST advisories are available through cooperating county agent offices and industry outlets in Cullman, DeKalb, Jackson, Mobile, and Baldwin counties.

SUCCESS STORY – Alabama produces over 350,000 kg of fresh market tomatoes annually with an estimated value of $18 million. In 1998, a complete recommendation package for disease and insect pests and for nutrient management was tested and validated on commercial tomato farms with cooperative growers for a second consecutive year. The project was supported by a grant from the USDA Southern Region IPM Program. The five grower cooperators selected for 1998 were Richard Collins, James Bedsoe, James Bolen, Max Bolin, and Eric White. Each grower set aside a one-acre tomato field for the purpose of comparing production recommendations from the Alabama Tomato IPM Program

with standard, calendar-based pest control program and production practices. On each farm, the field was divided in half with one half devoted to the IPM program and one half to the grower's standard practices. The IPM program consisted of a biweekly insect/disease scouting program combined with TOM-CAST, (a weather-based fungicide spray program). Fertility recommendations were made periodically based on results of soil and tissue analysis that determined the nutritional requirements of the crop.

The most significant disease problems to develop in 1998 were tomato spotted wilt virus (TSWV) and southern blight. Thrips, insect vectors of TSWV, and fruit worms were the most damaging insect pests. All of the participating growers indicated that they saved money on production costs by reducing pesticide applications when following the TOM-CAST program; which resulted in as much as a 40% reduction in fungicide inputs. Growers following the recommendations of the IPM field scout for insect pest management made six fewer insecticide applications on average compared to their standard program, which resulted in an average of more than a 30% reduction in insecticide use during the season. The growers reported no differences in tomato yields between the IPM and standard-practice field sections.

Another component of the project evaluated the efficacy of flame cultivation, mechanical cultivation, mulching, and combinations of these practices in okra, pepper, sweet corn, and tomato production systems in Alabama and North Carolina. Most treatments worked well with okra, pepper, and sweet corn, but preliminary results indicated that flame cultivation in a tomato production system might not be feasible due to the growth habits of the crop.

ASSOCIATED PROGRAMS

ALABAMA PESTICIDE APPLICATOR TRAINING PROGRAM

The Alabama Pesticide Applicator Training (PAT) Program serves to coordinate training for two main groups of pesticide applicators, private applicators and professional applicators. A main focus of the Program is to educate County Extension personnel to provide instruction for restricted-use private pesticide applicators in the safe and proper use of those chemicals. Training for these programs entails EPA instruction in ground water protection, filling and cleaning of equipment, calibration, and disposal of empty pesticide containers. IPM is also offered in these training sessions as an alternative for reducing overall pesticide use. At this time, there are more than 10,000 private applicators in Alabama and more than 2,500 professional applicators.

ALABAMA PESTICIDE IMPACT ASSESSMENT PROGRAM

In 1976, the USDA established the National Agricultural Pesticide Impact Assessment Program, more commonly referred to as NAPIAP. At that time there was a need to establish a framework for collecting and analyzing data regarding pesticide use in the United States. Each year, the Alabama Program conducts surveys of pesticide usage in various crops.

During 1998 the Program surveyed the cotton industry with the aid of the Alabama Agricultural Statistics Service. The information from these surveys will aid agricultural and pest management professionals in developing cost effective and environmentally sound management programs.

1998 IPM ALABAMA MINI-GRANTS PROGRAM

During 1998, the IPM Alabama Program supported four mini-grant projects; five fewer projects than in 1997. The reduction in the level of support occurred because a greater percentage of IPM funds were used for personnel salaries than in the past. We hope that this trend can be reversed so that the mini-grants program can continued to be supported from IPM Program funds. The purpose of the mini-grants program is to provide funding for small projects in the early stages of development or in areas that do not receive funding attention by larger grant programs. A committee composed of county agents, extension/research specialists, and Alabama growers review the grant applications and score the proposals. Highest-scoring proposals are approved given the funds available. Each project is funded for one year, and support may be extended if progress can be demonstrated.

Effect of Transplant Hardening on the Expression of Tomato Spotted Wilt Virus in Fresh-Market Tomato

Eric Simonne, Department of Horticulture, Auburn University, and John Murphy, Department of Plant Pathology, Auburn University.

The tomato spotted wilt virus (TSWV) has been causing an increasing amount of damage to the tomato industry in south Alabama. Growers reported that 1-3% of tomato fields were infected with TSWV in 1995 and 1996, and this figure increased to approximately 10% in 1997.

Most of the transplants used in tomato fields in south Alabama are produced by commercial greenhouses in South Georgia. After a 5 to 6 week growing period, transplants are pulled from Speedling trays and packaged in boxes before shipment to south Alabama. Due to time constraints transplants are often insufficiently hardened at the production site, and then need to be immediately established in the field upon arrival at the farm to ensure chances of survival. Consequently, no additional transplant hardening can be done on the farm and tomato growers observe that transplants are rather tender at establishment.

The susceptibility of a plant to infection by a virus decreases with increasing plant age. Therefore, a young plant is not only more susceptible to infection, but if infected at a young age will develop more severe symptoms of the disease. This is more problematic on a larger scale than the loss of production from isolated plants. Infected plants will go on to serve as a source of inoculum for other plants.

Research has shown that tomato plants grown under greenhouse conditions become significantly less susceptible to infection by cucumber mosaic virus and several potyviruses once the plant approaches the 9-10 leaf stage of development. Therefore, this study aimed at determining whether the length of hardening period of tomato seedlings has an affect on TSWV disease severity under natural conditions.

"Sunpride," "Sunbeam" and "Florida 47" tomato transplants were grown commercially for six weeks in 250-cell Speedling trays following production practices used by commercial greenhouses. On April 17, trays were transported from Tifton, GA to the Wiregrass Substation in Headland, Alabama. On the same day, one third of the transplants were established in the field without any hardening. The remaining plants were hardened for five and ten days and established in the field on April 22 and 27 respectively. White plastic and drip irrigation was used. The plants were staked and tied appropriately, and cultural practices followed current recommendations for fresh-market tomato production.

Researchers visited plots weekly and plants showing virus-like symptoms were flagged. Ten plants were selected from each plot, and evaluation of TSWV infection by ELISA (Enzyme Linked Immunosorbent Assay) was carried out on June 23. In each case, the first and last plant was sampled, as well as any flagged plants.

Virus-like symptoms were not observed in the field until May 20. During the study period, approximately 7% of plants tested positive for TSWV. No significant differences in virus levels were observed between cultivars and hardening treatments; this was probably due to low infection rate. Additional studies are planed to evaluate the effect of tomato transplant hardening on virus severity.

Viruses in Commercial Cantaloupe, Pumpkin and Watermelon in Alabama

John F. Murphy, Department of Plant Pathology, Auburn University, and Joseph Kemble, Department of Horticulture, Auburn University.

Plant viruses are a persistent threat to crop production. While some viruses occur on a frequent basis from one year to the next, others appear on a more sporadic basis. Knowledge of which viruses occur in a crop and their relative abundance from year to year provides a foundation for the development of management strategies. Researchers at Auburn University have initiated a series of statewide surveys to identify viral diseases in commercial vegetable crops. Those targeted for this study, the first year of a two-year survey, include cantaloupe, pumpkin, and watermelon with an emphasis on watermelon.

Through assistance from County Extension personnel, selected cantaloupe, pumpkin and watermelon fields were surveyed in Geneva and Houston counties (June, 1998), Autauga, Chilton and Elmore counties (July, 1998), and Blount county (August, 1998). Typically, 20 randomly selected plants from each field were tested with ELISA for several viruses known to occur on a frequent basis in cucurbits. Analyses were done for the following viruses: cucumber mosaic virus (CMV), papaya ringspot potyvirus (PRSV), watermelon mosaic potyvirus 2 (WMV 2), and zucchini yellow mosaic virus (ZYMV).

Fields in three areas of the state, (south, central and north Alabama), were surveyed. A visual assessment for virus-like symptoms revealed that a large percentage of plants in some fields were infected with a virus, though no distinguishing types of symptoms were apparent. Generally, two types of symptoms were observed: a typical viral-induced mosaic pattern on leaves (light and dark green patches throughout a leaf), or a bright yellow mottled symptom (bright yellow and green patches throughout a leaf).

Analysis of foliar tissue samples revealed the occurrence of each of the potyviruses (PRSV, WMV 2, and ZYMV), whereas CMV was not detected in any of the cantaloupe, pumpkin or watermelon samples. In south Alabama, PRSV and ZYMV were detected with ZYMV occurring on a more frequent basis. Plants in central Alabama were infected with WMV 2 and ZYMV with WMV 2 clearly being the predominant virus. In north Alabama, PRSV and WMV 2 were identified with WMV 2 occurring more frequently than PRSV. Interestingly, a tomato crop heavily infected with CMV was immediately adjacent to the pumpkin crop in Blount county, yet no CMV was detected in any of the pumpkin samples. These studies will help to further our understanding of the epidemiology of virus diseases in these crops and may lead to improved recommendations for management.

Plant Growth-Promoting Rhizobacteria as an Alternative Treatment for Soil Fumigation in the Production of Pine Seedlings in Forest-Tree Nurseries

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The use of methyl bromide as a soil-fumigant prior to sowing is the most common disease control practice in forest-tree nurseries throughout the United States. However, because it has been classified as an ozone-depleting compound, this broad-spectrum disease, weed and insect control treatment will be restricted in it's availability after the year 2001. Research to find a treatment as effective as methyl bromide is ongoing in agricultural as well as forestry research communities throughout the U. S. A few of the potential treatments to replace methyl bromide include the use of alternative chemical fumigants and fungicides, as well as non-traditional treatments such as steam, solarization, crop rotations, microwaves, resistant plant varieties, and biological control. Consequently, the identification of treatment to replace methyl bromide in forest-tree nurseries was the number one research priority in 1994 by the 49 members of the Auburn University Southern Forest Nursery Management Cooperative.

The use of plant growth-promoting rhizobacteria (PGPR) as a seed treatment prior to sowing is a novel disease control treatment that may be effective in increasing the growth rate and survival of seedlings. PGPR research on agricultural crops has been ongoing for nearly 15 years and has resulted in a number of commercially available PGPR products for peanut and cotton. However, research into

their ability to promote growth or control disease on forestry species such as conifers has not been done. Preliminary evidence has shown that the treatment of conifer seeds with PGPR strains prior to sowing has a number of beneficial applications in the production of conifer seedlings. Also, because of the intensively managed nature of forest-tree nurseries, the use of PGPR as an alternative to soil fumigation could easily be transferred to current production schedules. The focus of this research project examined if strains of PGPR can promote growth and produce high quality seedlings for reforestation programs throughout the southeastern U. S.

Two conifer bare-root nurseries, both members of the Auburn University Southern Forest Nursery Management Cooperative, agreed to participate with the PGPR research trials and provided equipment, nursery space, pine seed, and maintenance of the plots. One nursery was located in Atmore, Alabama, and the other near Byronville, Georgia. In each nursery, one section was designated for the study, of which 1/3 was treated with methyl bromide, 1/3 with the fumigant chloropicrin, while the remaining third was left untreated and served as the non-fumigated control. One day prior to sowing, loblolly pine seed was treated with *Bacillus subtillis* which has been shown to be effective on pine (promotes growth and enhances emergence). The seed was sown on April 12 and 17 and maintained under current operating practices that include weed, insect and rust control, top and root pruning to maintain seedling outplanting characteristics, and applications of fertilizer to maintain seedling vigor over the growing season. Planting patterns included both treated and untreated seed in each of the three sections. Rates of seedling emergence within treatments were assessed at weeks 2, 3, 4, 5, and 6, while final seedling densities were recorded at week 28. Seedling information gathered at the end of the growing season, 15 seedlings within each of the permanent plots were removed from the beds and seedling characteristics such as grade, stem caliper, height, biomass, and root area were determined.

The treatment of the seed with the bacterial agent did not interfere with either the process of seed sowing or the maintenance of the crop during the season. Thus, the use of bacteria as a seed treatment did not affect the sowing procedures used in bare root nurseries. The addition of the *B. subtillis* PGPR treatment to the seed coat prior to sowing increased the rate of emergence across both soil treatments over the non-treated seed. This increase was approximately two seedlings per day at the beginning of the season to less than one seedling per day at 5 weeks after sowing. This increased rate of emergence carried into final seedlings densities with treated seed resulting in 1.3 seedlings per square foot more than non-treated seedlings in both soil treatments.

The type of soil treatment had no effect on the number of seedlings in this particular study with no differences in the number of seedlings produced between seed and soil treatments. Thus, the addition of methyl bromide and/or chloropicrin to the soil did not result in more seedlings over non-treated soil. From a nursery perspective, the additional cost of soil fumigation is one of the largest inputs into the production costs, these studies indicate that perhaps soil-fumigation is not needed on a routine basis.

The additional 1.5 seedlings per square foot in plots that received the bacterial treatment provides a considerable economic benefit. On average, each extra seedling produced per square foot of nursery bed is worth $1,000 per acre to the nursery. In these particular trials, the extra 1.5 seedlings per square foot would bring in an extra $1,500 per acre of area sown with a minimal cost for seed treatment. As a comparison, soil fumigation with methyl bromide or chloropicrin costs about $1,700 per acre and the cost is expected to increase as methyl bromide becomes scarce due to limits in its future production and availability.

CONTINUED REFINEMENT OF INTEGRATED MANAGEMENT TACTICS FOR THE TIP MOTH RHYACIONIA FRUSTRANA USING PHEROMONE TRAPS

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The Nantucket pine tip moth, *Rhyacionia frustrana* (Comstock), is the most serious pests of Christmas tree and commercial plantations and landscape trees. The larvae of this moth feed inside the growing shoots of various species of pines killing the tips and causing growth and form loss. Damage by this moth often results in severe

stunting, stem deformation, and in extreme cases, death of the host. Tip moth injury is most damaging on seedlings and saplings under five years of age. Loss of tree form is common where heavy attacks cause forks, crooks or multiple trunks. In commercial plantings, such attacks can result in significant increases in compression wood. loss of wood quality and increased rotation time. Where trees are grown for aesthetic purposes, as in Christmas tree plantations or in the landscape environment, the deformed trees resulting from tip moth attacks are particularly undesirable.

Foliar applications of pesticides are generally the most effective approach to controlling tip moths but timing of application is very critical since the young larvae quickly tunnel inside the pine shoot where they are protected from the toxicants. Spray timing models are dependent on pheromone traps to detect the initiation of moth flight, and thus subsequent biological events. However, commercially available synthetic pheromones have not proven satisfactory because of variation in efficacy and the limited life. Since spray applications are made over large areas accurate base-line information is very important. In the absence of accurate predictive information, some commercial operators are making multiple pesticide applications in an attempt to control the pests. In this study we evaluated several factors that influence the effectiveness of pheromone trap collections involving three separate studies. The first study was a continuation of a previous test of pheromone dispensing mechanisms. In the second study we examined the performance of a number of different types of pheromone traps that are available commercially. We expect that some of the trap designs were more effective than others. In the third test we considered trap color as a factor influencing moth collections. In our previous work we noticed that different colors of commercially available traps varied in the numbers of moths caught. We believe that the results of these tests can be used to develop improvements in the efficacy of control of pine tip moths and a reduction in number of pesticide applications.

Grant Funds Obtained by IPM Alabama Personnel in 1998

COTTON

Smith, R. H. **Industry Support Funds. $10,100.**

Smith, R. H. **Commodity Grants. The Cotton Foundation. $2,500.**

Smith, R. H. **Competitive Grants. Cotton Incorporated. $18,550.**

FORAGES AND SMALL GRAINS

Flanders, K., Mask, P., and Buntin, D. **Biological Control of Cereal Leaf Beetle. Alabama Wheat and Feed Grain Committee. $1,500.**

Flanders, K., Mask, P., and Buntin, D. **Development of Action Thresholds for Cereal Leaf Beetle. Alabama Wheat and Feed Grain Committee. $9,600.**

Flanders, K., and Mask., P. **Performance of Genetically Engineered Corn in Alabama. Alabama Wheat and Feed Grain Committee. $12,500.**

Mask, P., Murphy, J., Flanders, K., and Halbert, S. **Aphid Populations and Timing of Arrival into Alabama Wheat Fields in Relation to Barley Yellow Dwarf Virus. Alabama**

WHEAT AND FEED GRAIN COMMITTEE. $3,000.

Mask, P., Monks, D., Delaney, D., Flanders, K., Gazaway, W., Goodman, R., and Hairston, J. **Evaluation of Precision Farming Technology on Two Alabama Farms. Alabama Wheat and Feed Grain Committee. $18,700.**

Mask, P., van Reissen, H., and Flanders, K. **Evaluation of Aphid Behavior Modifying Insecticides for Control of Barley Yellow Dwarf Virus on Wheat. Alabama Wheat and Feed Grain Committee. $5,000.**

Mask, P., Flanders, K., and Gazaway, W. **Producer Applied Insecticide and Fungicide Seed Treatment. Alabama Wheat and Feed Grain Producers Committee. $5,000.**

Mask, P., and Flanders, K. **On Farm Demonstration of Bt Corn Hybrids. Alabama Wheat and Feed Grain Committee. $4,000.**

Mask, P., Flanders, K., Gazaway, W., and Goodman, R. **Technical Support for Extension Grain Crops Improvement Team. Alabama Wheat and Feed Grain Committee. $26,250.**

Cobb, P., Oi, F., and Flanders, K. **Imported Fire Ant Management. Alabama Department of Agriculture. $65,000.**

FORESTRY

Brewer, W. **Continued Refinement of Pheromone Trapping Devices for the Tip Moth, Rhyacionia frustrana, Using Pheromone Traps. IPM Mini-Grants Program, Auburn University. $3,250.**

Brewer, W. **The Influence of Trap Color and Form on Collections of the Tip Moth, Rhyacionia frustrana. Cooperative Grant from University of Georgia, Department of Entomology. $2,500.**

VEGETABLES

Bauske, E. M., Monks, C. D., Sikora, E. J., Zehnder, G. W., Patterson, M. G., Monks, D. W., Heiniger, R. W., Goodman, W. R., and Kemble, J. M. 1996 – 1998. **Implementation of Tomato IPM Practices. USDA/Southern Region IPM. $127,000.**

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