BUILDING ROADS AND BRIDGES FOR INTEGRATED PEST MANAGEMENT IN FLORIDA: A TRIBUTE TO MADELINE AND CHARLES MELLINGER OF GLADES CROP CARE

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The 2008 Florida Entomological Society Pioneer Lecture honored Madeline and Charles Mellinger in recognition of their extraordinary accomplishments in pioneering integrated pest management (IPM) in Florida agriculture. The Mellingers are owners of Glades Crop Care, so named because of its proximity to the Everglades. Established in 1972 and headquartered in Jupiter, Glades Crop Care was the first privately owned crop scouting and consulting firm in Florida. Due to the Mellingers' expertise and determination, Glades Crop Care has become the largest independent crop consulting firm in the southeastern United States, overseeing more than 60,000 acres of high value specialty crops. Glades Crop Care promotes IPM and sustainable agriculture to help Florida growers produce crops profitably with minimal risk to human health and the environment. In recognition of their pioneering pest management programs, the Mellingers have received several prestigious awards, including the U.S. Department of Agriculture (USDA) Award of Merit, U.S. Environmental Protection Agency (EPA) Champ Award, Florida State Horticultural Society President's Award for Industry, and most recently the First IPM Achievement Award from the National IPM Symposium.

Madeline Mellinger grew up in Blacksburg, Virginia, where her father was a professor of chemistry at Virginia Polytechnic Institute (now Virginia Polytechnic Institute and State University, better known as Virginia Tech). Her entomology experience began when she worked with Dr. Mary Ross at Virginia Tech dissecting cockroaches and staining microscope slides for genetic research. Her promise was evident early, as she won the Junior Science Award at Virginia Tech the same year that her father coincidentally received the Senior Science Award at the Virginia Academy of Sciences. Most of her college coursework was at Virginia Tech in biology, and she also spent a summer at the University of Virginia's Mountain Lake Biology Station. She described the place as "Spartan," requiring a television to be brought in to watch the moon landing. Madeline studied entomology at the University of Georgia and subsequently graduated *summa cum laude* from the University of Louisiana at Monroe. After graduating, she worked as a junior entomologist at an analytical pre-harvest laboratory, J&W Agro-eco Labs. This company became bankrupt but fortunately Madeline was asked by 6 celery and sweet corn growers in Belle Glade to continue the service. She accepted their request and established Glades Corp Care. As Madeline's stature grew, she served as an advisor to the U.S. Congress, National Academy of Sciences, EPA, and Cooperative Extension Service at several universities. She has been appointed by 3 consecutive U.S. Secretaries of Agriculture to the National Sustainable Agriculture Advisory Committee and was the chairman from 1995 to 1997. She also was invited to join the Florida Agribusiness Council in 1999 and has served as the vice-president.

Dr. Charles Mellinger grew up in Lancaster, Pennsylvania, preferring to work on his grandfather's 10-acre truck farm rather than his father's lumber and building supply business. The family grew an acre of staked tomatoes that he rouged at an early age to prevent mechanical transmission of tobacco mosaic virus (TMV) from infected plants. He earned his B.A. in biology from Goshen College in Indiana and his Ph.D. in Botany and Plant Pathology from Michigan State University. Charles moved to Florida where he became Corporate Plant Health Director at Yoder Brothers. He is now Director of Technical Services at Glades Crop Care. Charlie is on the Board of Directors of the National Alliance of Independent Crop Consultants (NAICC) and is a Certified Plant Pathologist as well as a Certified Crop Consultant. He serves on the Board of Directors of Protected Harvest and is a member of the Entomological Society of America, Florida State Horticulture Society, American Phytopathological Society, and the Florida Plant Pathology Society. The NAICC voted him Outstanding Consultant of the Year in 1998 and presented him with the Extraordinary Service Award. He also received a Florida Horticultural Society Presidential Award 3 times, along with many other accolades.

Several major events led to the development of IPM and its promotion by Glades Crop Care. At one time, it was common practice to tank mix DDT (Dichloro-diphenyl-trichloroethane) with a variety of chemicals, such as toxaphene, methyl parathion, a wetting agent, a sticker, maneb (manganese ethylene bisdithiocarbamate), triba-

sic copper sulfate, streptomycin, wettable sulfur, urea LB (Lo-Biuret Urea), epsom salt, magnesium sulfate, potassium nitrate, manganese sulfate, Solubor (boron), sodium molybdate, Foam Buster, molasses, and Cygon (dimethoate). By 1947, however, insect resistance to DDT became widespread and there were unacceptable non-target effects. These kinds of limitations in the use of pesticides led to the Integrated Control Concept described by Vern Stern, Ray Smith, Robert van den Bosch, and Ken Hagen in 1959 (Hilgardia 29:81-101). In 1962, Rachel Carson's book, Silent Spring, was published, escalating concerns about pesticide misuse and overuse. There was a major reorganization of the USDA in 1970, followed in 1972 by extensive amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947. Also during 1970, responsibility for Federal regulation of pesticides was transferred to the EPA and the Agency eventually cancelled all crop uses of DDT. The USDA Cooperative Extension Service established the national IPM program by 1975 with every state 1862 Land-Grant university receiving Smith-Lever 3(d) funding.

During the 1970s, Madeline Mellinger worked 7 days a week developing IPM options for Florida vegetable growers. She traveled about 1200 miles a week in her little Chevrolet to monitor weather stations and aphids caught in spore and water pan traps. This work was accomplished in cooperation with scientists at the University of Florida (UF), Institute of Food and Agricultural Sciences (IFAS). Initially, she worked with Dr. Dick Berger on installing and inspecting spore traps for detecting early blight of celery and northern corn blight, and forecasting blight epidemics. These diseases were a major concern for the giant celery and sweet corn industry in the Everglades area at that time. She worked with other UF/IFAS scientists to monitor aphids for growers producing celery, sweet corn and leafy vegetables. During 1975, Glades Crop Care began plant breeding trials and assumed responsibility for providing pesticide recommendations for sweet corn, snap beans, and sugarcane. Lettuce mosaic virus indexing was added by 1976 in cooperation with Dr. Tom Zitter. In 1977, Glades Crop Care began insecticide efficacy trials on peppers, as the abundance of leaf miner species began to shift from *Liriomyza sativae* to *L. trifolii*. Tomato transplants were added to their services after 1979.

A major expansion of Glades Crop Care took place during the 1980s, beginning with the addition of Dr. Charles Mellinger. Dr. Jerry Brust was hired by 1981, enabling operations to spread into west and north Florida. IPM for *Chrysanthemum* spp. and baby's breath, *Gypsophila* spp., was added to their services by 1985. The company expanded into Puerto Rico that year to provide pest management services for citrus. Between 1986 and 1989, Glades Crop Care conducted pesticide residue trials for developing good laboratory practices (GLPs) and Madeline testified before a congressional committee on pesticides and food safety. She and Charlie established a contract research farm at Homestead about the time that silverleaf whitefly became a major pest in Florida. Another major pest, *Thrips palmi*, was identified for the first time in the Caribbean and later in Florida during 1991 by Dr. Galen Franz of Glades Crop Care. The USDA presented an Appreciation Award to the organization's scientists who conducted research on managing this pest.

As a well-established and highly successful company, Glades Crop Care has become involved in a wide range of important IPM programs. The organization was invited to be a charter member of the EPA Pesticide Environmental Stewardship Program (PESP), was awarded PESP grants, coorganized an EPA IPM Innovations Tour in South Florida, and was recognized by EPA as a PESP Champion. Glades Crop Care began worker spray tracking services in accordance with EPA Worker Protection Standards (WPS) and today is the only crop consulting firm in Florida to provide this service. The company has contributed several major advancements in IPM, including USDA Small Business Innovation Research (SBIR) projects that funded development of "THRIPS, a Computerized Knowledgebase for the Identification and Management of Thrips Infesting Vegetables in the United States." Other important projects were conducted as part of the USDA Pest Management Alternatives Program (PMAP), Risk Avoidance and Mitigation Program (RAMP), and Sustainable Agricultural Research and Extension Program (SARE). Glades Crop Care currently provides scouting supported by geographic information system (GIS) and geographic positioning system (GPS) technologies, resistance management practices, and IPM measurement and preventative methods for selected agricultural pests. Additionally, Charles Mellinger began serving on the EPA-USDA Tolerance Reassessment Advisory Committee (TRAC) and Glades Crop Care has initiated "Food Safety Education and Audits" to help meet the stringent requirements set by the buyers of their client's produce. Together with Dr. George Agrios and Dr. John Capinera, both Madeline and Charles Mellinger were instrumental in establishing the Doctor of Plant Medicine Program at the University of Florida. This program, currently under the direction of Dr. Robert McGovern, is designed to produce doctoral-level plant health practitioners and several graduates have become employees of Glades Crop Care. Recently, in collaboration with Dr. Dave Schuster, the organization's scientists began to release parasitoids for managing the pepper weevil. An IPM service has been added for woody ornamentals and turfgrass, in addition to a food safety program in cooperation with the Florida Fruit and

Vegetable Research and Education Foundation (FFVREF). Training and consulting on food safety assisted vegetable growers in complying with Food Quality Protection Act (FQPA) standards. Additionally, studies began on a methyl bromide critical use exemption for managing plant parasitic nematodes. Glades Crop Care celebrated its 30th anniversary in 2002.

A special example of the contributions of Glades Crop Care to food safety in Florida and the nation is the service of Charles Mellinger on the Board of Directors for Protected Harvest. Protected Harvest is a non-profit organization with the mission of advancing and certifying the use of sustainable agricultural practices through the development of stringent, transparent and quantifiable standards. It was established in 2002 to provide independent certification of farms that meet required IPM standards. Charles has been instrumental in providing guidance and expertise on IPM and sustainable agricultural practices for this organization. Dr. Dan Sonke, a graduate of the UF/IFAS Plant Medicine Program established in collaboration with the Mellingers, is the Director of Research for Protected Harvest.

Today, Glades Crop Care has 25 regular and 35 seasonal employees to serve farmers and agribusinesses seeking sustainable solutions to agricultural production challenges. These plant health professionals strive to optimize food production and assure its safety, while protecting the environment and promoting safe working conditions. They provide 3 main services: (1) Advanced crop scouting, and pest and beneficial insect population analyses, to give growers accurate IPM recommendations; (2) Food safety programs, both educational and auditing, for fresh market crops and packing facilities; and (3) Research on IPM alternatives, including efficacy and residues of new pesticide products. They are dedicated to serving their clientele by providing these science-based services and advanced IPM programs. The Florida Entomological Society recognizes Madeline and Charles Mellinger for their pioneering efforts to build roads and bridges for IPM in Florida.

The Florida Entomological Society Pioneer Lecture Committee chaired by Dr. Joe Funderburk, selected Dr. Freddie Johnson to prepare and present a lecture honoring Chares and Madeline



Fig. 1. Left to right, Dr. Freddie Johnson, Dr. Joe Funderburk, Madeline Mellinger and Dr. Charles Mellinger.

Mellinger of Glades Crop Care as pioneers in Florida entomology. As an entomology professor and Extension entomologist, Dr. Johnson was responsible for obtaining, analyzing, and preparing useful and practical information relating to insects, including their taxonomy, biology, and management. To communicate this information, he worked closely with the extension, teaching, and research faculty and staff members of the Entomology and Nematology Department as well as other UF/IFAS departments, research and education centers, agricultural leaders, farmers and growers, food and agriculture related industries, county extension faculty, and many segments of the general public. As a highly successful and experienced extension entomologist, Dr. Johnson strived to develop programs by gathering existing knowledge and conducting research and demonstration projects that advanced IPM in Florida.

Dr. Johnson specialized in solving an array of pest management problems exacerbated by a lack of safe and legally available insecticides. He worked with the Florida Department of Agriculture and Consumer Services, in conjunction with the EPA, to justify special local needs (24c) and Section 18 emergency registrations for insecticides needed to protect some of Florida's most valuable crops. Throughout his career, he provided the needed research information for these programs. His educational activities were closely linked to these accomplishments, especially in the area of education and training required for clientele to adopt IPM practices. Dr. Johnson's success was evident in increased crop scouting and accurate identification of pest species. He has helped growers "move away from the "days of old" when "windshield inspections" for crop pests was enough to trigger a spray application." Growers now are more aware of the value of beneficial arthropods and other forms of natural controls, and spraying insecticides by the calendar is no longer acceptable.

Dr. Johnson had many notable achievements as a professional entomologist and received several special honors and awards. He copyrighted some of his Extension materials and published numerous book chapters, scientific journal articles, extension circulars, pest management guides, and progress reports. One of his major accomplishments was significantly upgrading the Insect Management Guides that contained insect control and management information for all agronomic crops in Florida. The guides listed the insecticides that could be used legally on each crop, along with their generic and trade names, application rates, pre-harvest times and other applicable warnings and instructions. IPM, scouting, economic thresholds and other information was contained in these guides. Much of his work involved alien invasive species, such as the sweet potato whitefly, vegetable leafminer, western flower thrips, melon thrips, diamondback moth, pepper weevil, and various armyworms and pestiferous mites.

Dr. Johnson frequently is invited to make presentations at professional conferences and is well known for his expertise and candor. His method of instruction is to tell stories that portray important principles that he has learned during his years in the field of entomology. He retired from UF/IFAS in 2007, as District III Extension Director for 13 counties in Central Florida, leaving a legacy of pioneering IPM achievements.

Acknowledgments

The authors thank Ken Johnson for transcribing the audio tapes of Dr. Freddie Johnson's lecture and Dr. Jennifer Gillett-Kaufman for providing information used in the paper.