IRAC
Insecticide Resistance Action Committee

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About This Issue

Welcome to the this special issue of eConnection, reporting back on the sponsored IRAC Symposium at the Entomological Society of America Annual Meeting. IRAC has the mission of fostering communications and developing practical strategies for Insecticide Resistance Management (IRM). Sponsoring an annual symposium at the ESA, the largest gathering of entomologists, has and continues to be an effective mechanism for accomplishing this goal. Although well attended, many who did not hear the symposium in person could benefit from the information. IRAC is therefore providing a short executive summary in the form of an eConnection along with a link to the slide presentations located on the IRAC web site

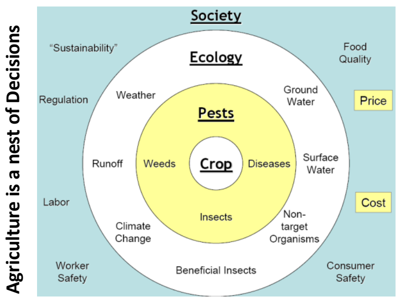
As always we hope you enjoy the issue.

Symposium Topics

The theme of the 2010 annual ESA meeting was: "*Entodiversity – Disciplinary, Biological and Geographical"*. IRAC-US incorporated this theme into the sponsored IRAC symposium which was titled: *"Understanding and Capitalizing on Agricultural Biodiversity in IPM and IRM"*. The speakers addressed the theme of agricultural biodiversity from a spatial and temporal perspective. In addition to key pests such as *Spodoptera frugiperda*, *Helicoverpa zea*, *Bemisia tabaci* and *Lygus lineolaris*, the invited speakers discussed ecosystem services and pollinators relative to biodiversity.

IRAC US - Our role in IRM

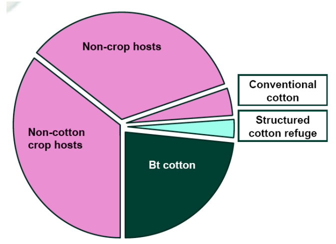
Daniel Vincent, DuPont Crop Protection: Agriculture is a necessary and challenging occupation. Pressures abound that must be dealt with; such as, diminishing arable land, finite water resources, available labor, regulatory pressure, and societal perception. IRAC plays a role in supporting activities that help us understand resistance mechanisms, monitor and catalog resistance development, and educate the user public on how to prevent or respond to resistance outbreaks.



Spatial & temporal diversity of polyphagous pests - Corn earworm (*Helicoverpa zea*)

Patricia V. Pietrantonio, Bradley W. Hopkins, Texas A&M University: *Helicoverpa zea* is highly polyphagous and migratory with approximately 5-7 generations per year. The cost of controlling *H. zea* is estimated to be $1Billion. With the expectation of climate change, the range of *H. zea* will expand to most of the U.S. in the 21st century. By using the vial bioassay in 1998, the first resistance to pyrethroids was demonstrated and this was a heterozygous resistance. It was also demonstrated that homozygous resistance in *H.zea* may carry significant fitness costs. Within a population or adjacent populations the resistance ratio may not always be the same between pyrethroids. Also, the percent adult males that survive from crops may be more resistant than those from the traps. Are we underestimating resistance?

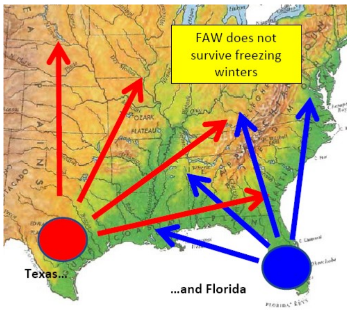
Natural refuge of Bollworm and Budworm in GM crops



John Greenplate, Graham P. Head, Monsanto Company: Cotton refuge area – either 20% sprayed or 5% unsprayed. With Bollgard II, it was amenable to reduction of refuge area. As a condition of re-registration of Bollgard II, Monsanto had to demonstrate that there were alternate hosts for bollworm. The study looked at 2002 – 2006 cropping patterns, satellite imagery, adult moth trapping and C3/C4 hosts. There were 5 states and 4 studies per state. It was determined that most cotton bollworms are produced by non cotton hosts, especially C4 plants. *H. virescens* has many non-cotton hosts. Conclusion is that there is significant contribution of non-host plants which can be considered the 20% effective refuge.

Fall armyworm: Management of a genetically-complicated migratory pest

FAW Migration



Robert Meagher, USDA-ARS-CMAVE; Rodney N. Nagoshi, USDA-ARS: Fall armyworm (FAW, *Spodoptera frugiperda*) is a major pest of sweet corn and there is no known diapause. In addition to sweet corn, it feeds on several field crops and vegetables and has a wider host range in the tropics. FAW is the number 1 pest on sweet corn in Florida and attacks both the whorls and tassels. There are several predators and parasitoids, but they are not considered in the management decisions, and the growers rely on chemicals for control. In terms of biodiversity, there are 2 host strains (rice/corn) and these strains were not caused by feeding on these hosts. The host strains are separated by genetic markers and determined susceptibility. The rice strain is more susceptible to plant resistance and Bt toxin. Biodiversity of over-wintering and/or migratory haplotypes was discussed. The ratio of haplotypes is different within strains. Texas moths are moving further than Florida moths.

Whitefly management - Multicrop systems

Peter Ellsworth, John C. Palumbo, Al Fournier, Xianchun Li, University of Arizona; Steve Naranjo, USDA-ARS ALARC: When considering the management of *Bemisia tabaci* (B biotype), one must consider biodiversity through the lens of faunal and of host diversity. Biodiversity can both mitigate pest issues and exacerbates them, as illustrated by the Arizona multi-crop system. IPM and IRM approaches in Arizona have been sensitive to the constraints of the systems in which they are deployed. In cotton, faunal diversity and emphasis on selective tactics has allowed growers to capitalize on the key ecosystem service of biological control through natural enemy conservation. Natural enemies in concert with other natural control factors (e.g., weather) provide for “bioresidual” that extends beyond the chemical residual of selective insecticides like pyriproxyfen, buprofezin, and spiromesifen. This has permitted an extremely efficient management system that requires few inputs for the control of whiteflies and other pests, and continued emphasis will be placed on leveraging additional natural controls through discovery and deployment of selective practices. In contrast, vegetable growers face the “produce paradox”, where consumers both demand perfect produce but wish the industry to use less or fewer pesticides. Under these conditions, biocontrol does not work, especially because any arthropod found in the agricultural product is considered a contaminant. Thus, the strategy for vegetable IPM/IRM has been to deploy safer, reduced-risk chemistries and to “outrun” resistance development by greatly diversifying the modes of actions available to growers. As an extraordinary example of cooperation among producers of each of these crops (cotton, vegetables, melons), growers in Arizona voluntarily restricted neonicotinoid usage to no more than two, non-consecutive uses per cropping community. Adoption rates have been high, supported through extensive education and fortuitous deployment of new products with different modes of action. Future work in Arizona is concentrating on development and integration of pyrifluquinazon, spirotetramat, and cyazypyr into our IPM/IRM systems.

Impact of *Lygus lineolaris* (TPB) management on biodiversity in cotton IPM

Jeffrey Gore, Don Cook, Angus Catchot, Fred Musser, Mississippi State University; B. Rogers Leonard, Louisiana State University AgCenter; Gus Lorenz, University of Arkansas; Scott D. Stewart, The University of Tennessee: Cotton production is an intense agricultural pursuit In Arkansas, Louisiana and Mississippi. In an experiment where insecticide applications were made for tarnished plant bug (TPB) control, 6 applications yielded 200 lbs. lint/acre, while 12 applications yielded 2000 lbs. lint/acre. Currently, TPB is resistant to pyrethroids and acephate. The insecticide program for control of TPB is organophosphates at planting, followed by neonicotinoids at 1st square, followed by organophosphates and pyrethroids at 1st flower, and then everything at pink flowering. The control costs are increasing for the growers. With the intense sprays made for TPB, there has been an increase in secondary pests such as cotton aphid and spider mites. The aphids are now showing a tolerance for the neonicotinoids, and the resistance is believed to be metabolic. There are additional options for cotton aphid control – Transform (Sulfoxaflor) – future registration and Carbine (flonicamid).

Managing agricultural landscapes for beneficial insect services

Doug Landis, Michigan State University: Ecosystem services, such as pollination and predation, add approximately $7.6 Billion of value each year to the U.S. economy. There has been significant human population growth and a decline in diversity of plants, birds and mammals. Birds are declining at the fastest rate. Ecological services in three ecosystems were compared to understand the effects of monoculture on those services. Two ecosystems, corn and switch grass, are used for biofuel production. The third, mixed prairie, was a control for the other two. Bee abundance was highest in switch grass and prairie, which was determined by the nesting success and stem nesting bees. Predator diversity was greatest in diverse grasslands – crop effect and landscape effect. Predation services were lower in corn and higher in switch grass. For birds, only 3 species nest in corn. Ways to maintain ecosystem services while growing food and fuel were provided.

Assessing ecosystem services provided by invertebrates in farmland - a 'bottom-up' approach

Stephen Wratten, Lincoln University: This provocative talk confirmed the work presented earlier and showed ways that could maintain and/or enhance ecosystem services in cropping systems. Three services were discussed, including pollination, biological control (predation, parasitation), and nutrient cycling. Examples indicated that if refuge for beneficial insects was included in the landscape of monocultures, pest damage could be reduced to below economic thresholds. In the case of biological control, refuge plants need to provide SNAP (shelter, nectar, alternative prey, and pollen) in order to enhance the service to economically viable levels.

Ecosystems and agricultural relationships

John Finisdore, World Resources Institute: Biodiversity and Ecosystems Services – provisioning, regulatory, cultural, sustaining ecosystems. Ecosystems services metric evaluates flow of services from the farm and how this affects larger areas. More complete systems – water quality, water quantity. Water markets – payments for ecosystems services. Water quality trading – how cap can be used? Enhanced ecosystems services will be in the next farm bill.

Pollinator services in agricultural landscape

Hilary Sardinas, Claire Kremen - University of California-Berkeley: Hedgerow restoration / buffer strips – evaluation of nesting and foraging of bees. A study was set up in Yolo County. The hedgerow sites were near tomato fields. There were higher bee species diversity in the hedgerows and these are useful for exporting pollinators to adjacent crops. It is important to evaluate cost of hedgerows relative to ROI. However, it was found that hedgerows distribute bees rather than concentrating them. Since higher pollination in some crops increases yields, it is estimated that hedgerows pay for themselves in 5 to 7 years.

Pollinator diversity in urban settings

Gordon W. Frankie, University of California, Berkeley: Statewide surveys that began in San Francisco in 1999 and expanded to 10 cities by 2005 are conducted every 4-6 weeks during the growing season. In California, there are a high percentage of non-native plants grown and the native bees do not actively visit these non-native plants. The 300 plus species of California native bees do not visit plants native to South Africa, New Zealand and Australia. Another aspect of the work was with an organic farm, Frog Hollow Farm that is involved with community supported agriculture (CSA). They have found that there are 25 native species common to urban environments in this type of farm. Information on this survey is available at Helpabee.org

These symposium notes and brief summaries are at just that and for more information please view the slide sets on the IRAC website where available or contact the presenters directly. Specific questions for your area should be directed to your local university or crop protection industry representative.

Feedback

The eConnection is prepared by the IRAC International Communication & Education Working Group and supported by the 15 member companies of the IRAC Executive. If you have information for inclusion in the next issue of eConnection or feedback on this issue please email aporter@intraspin.com.

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