Impact of Regulatory Decisions on Emerging Pest Control Research

Margaret L. Allen, USDA/ARS BCPRU Stoneville, MS
mlallen@msa-stoneville.ars.usda.gov

Pest control research is an enormously broad field. Pests can be segregated into broad biological categories such as rodents, insects, nematodes, weeds, fungi, bacteria. Pests can be categorized by the product or environment in which the pest occurs such as crop pests, stored product pests, forest pests, turf pests, structural pests, vectors of plant or animal (including human) disease, or just nuisances. The battle to control pests is constant; eliminations are rare, but control measures are very effective. Nationwide chains of grocery stores contain both fresh and preserved foods that are nearly devoid of pests or pest damage. Challenges for pest control include recently reported bacterial contamination of bagged spinach, and the increasing presence of *Cimex lectularius*, the common bed bug, in nationwide lodging establishments. Another example of a pest control challenge directly associated with biotechnology is the problem of secondary pests in insect resistant transgenic crops (figure 1).

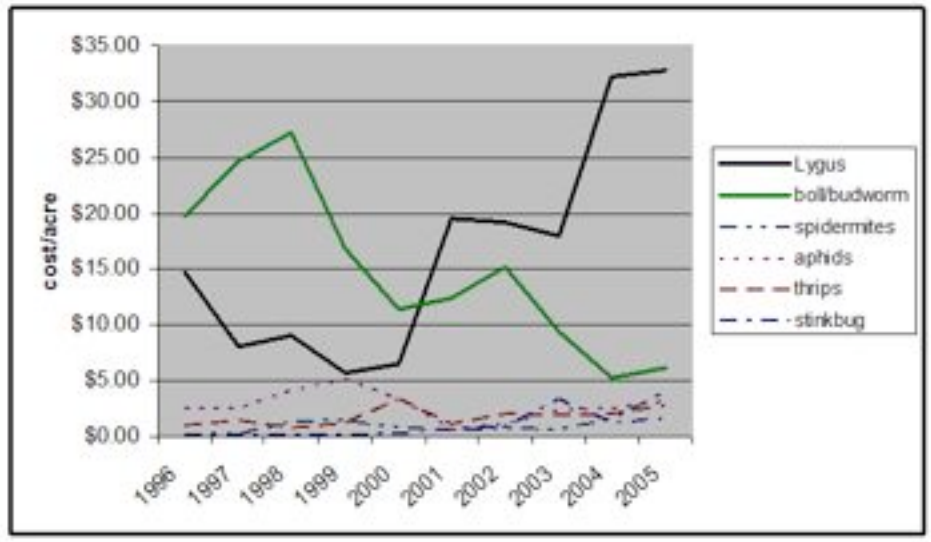

Figure 1. Cotton Insect Losses (Mississippi Summary) data extracted from http://www.msstate.edu/Entomology/Cotton.html (Williams, MR)

Current topics under investigation by pest control research scientists include resistance research, chemistries, molecular genetics, and biological control. These broad topics often overlap.

Resistance research is a critical area of pest control. Resistance to chemical pesticides has been documented for over 50 years. Ongoing research includes detection and monitoring of resistant organisms. Elucidation of pesticide resistance mechanisms at the biochemical and genetic level continues. While some research projects utilize field and in vitro methods, many projects require live pests in the laboratory. Laboratory strains of pesticide resistant pest insects (or fungi, or weeds, etc.) are valuable research assets. Regulations regarding the containment and transfer of biological materials could be viewed as restrictive to scientific progress. A collaborator in another state or country would require a permit from APHIS and/or the state or country, and possibly a facilities inspection or certification.

New chemical compounds and formulations are continually sought and tested for use against pests. Naturally occurring plant compounds that are toxic or repellent to insects, mites, and fungi are reported in pest management and other journals. Synthetic compounds based on known pest toxicology, growth regulation compounds, and chemical communication compounds are reported. Testing these compounds again requires live pests in some sort of containment, and the same constraints mentioned above apply. If a scientist wishes to study effects of a compound on a non-target organism, for example a fungus, another arthropod, a reptile or amphibian, or a mammal, other regulatory hurdles are present.

Molecular genetic studies on pest insects are increasing. Genetic manipulation aimed towards insect control will be described in other presentations, and the progress described is laudable. One must bear in mind however, that sterile insect releases can only work on one species of insect at a time, and there are a multitude of pests, many of which do not fit into the sterile insect paradigm. Molecular genetics and genetic manipulation technology can be powerful tools for gene discovery, and key to the next generation of pest control strategies. Gene discovery projects directed towards control of a wide range of insect pests including human, animal, and plant disease vectors are targeting gene pathways associated with the insect cuticle, insect development, and a wide variety of insect digestive enzymes. Manipulated pest insects on the scale of *D. melanogaster* could speed the path between gene discovery and control methods. Permit and containment requirements for both plant pests and transgenics need to be clear and manageable to facilitate this type of research project.

Biological control is the use of one biological organism to control another, such as releasing beneficial bacteria, fungi, or arthropods to limit pest infestations. Part of the Plant Protection Act states that "biological control is often a desirable, low-risk means of ridding crops and other plants of plant pests and noxious weeds and its use should be facilitated by the […federal agencies] whenever feasible…" Still, regulation has impeded movement of these agents; in recent years there was some concern that providers of biological control agents (BCA's), and biological control research would be regulated out of existance. Regulations prohibiting the movement of biological agents of any sort, instituted in response to the threat of bioterrorism, effectively halted importation of experimental and commercial biological control organisms.

Research on biological control agents and genetic research, especially recombinant genetic research, face difficulties in combining. Many producers of biological control agents (BCA's), and scientist that study them, promote a reputation of environmentalism. The regulatory process, which is very visible by design, could be perceived by those who equate environmentalism as anti-GMO sentiment as a reputation risk.

Part of the APHIS BRS website (http://www.aphis.usda.gov/brs/arthropod_news.html) states that "safe development of agricultural biotechnology products promotes increased public confidence in biotechnology-derived agricultural food and food products." Regulatory agencies also promote safe research; however, instilling public confidence in recombinant DNA research is a bigger challenge.