CRANBERRY PEST MANAGEMENT IN THE FUTURE

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The Food Quality Protection Act of 1996 (FQPA) is likely to have a profound impact on cranberry pest management. The organophosphate and carbamate insecticides will be amongst the first groups of pesticides to come under rigorous review. The great majority of synthetic insecticides used on cranberry belong to these two chemical groups (Table l), and their usage patterns will undoubtedly change once FQPA becomes fully implemented, supposedly by 2006. The changes may be substantial, to the point that some products in common use today may not be available at all in the future; usage patterns will certainly change.

Table 1. Insecticide groups commonly used in cranberry insect control (trade names).

Organophosphate Group	Carbamate Group
Diazinon	Sevin
Guthion	
Lorsban	
Orthene	

Partly because of FQPA, we may be entering the period of greatest change in insect control on horticultural crops since the golden age of broad spectrum synthetic organic insecticides starting in the late 1940s. But FQPA is not the only factor responsible for the changes on the horizon. Consider the following.

Consumer interests drive marketing. Today's consumers are more vocal and certainly concerned about the safety of the food they eat as well as the impacts of farming (and other human activities) on our resources and the natural environment. Although consumers probably often make decisions with poor information or no information, the fact still remains that they will be more likely to consume products that are perceived to be produced as safely as possible.

Many studies recommend safer practices. Various national studies have pointed to the need for safer and more sustainable pest management practices. These are studies conducted by objective scientific groups that evaluate real data.

Farmers and farm groups seek alternatives. Many major farming groups supported the legislation that resulted in the Food Quality Protection Act because they see it as an overall benefit to our agricultural economy. In my role as an extension entomologist, I get numerous questions from individual farmers each year about how to reduce reliance on using broad spectrum pesticides. The reasons are usually threefold: (1) protection of the health of the farm

family and workers, (2) the strong environmental ethic held by many farmers, and (3) the increasing demand by consumers for safer foods.

Agrichemical industry recognizes need for new types of products. The agrichemical industry is definitely switching directions in the development of new pesticide products. In the past, insecticides were broad spectrum. In modern pest management, the use of pesticides is much more highly targeted to specific problems known to occur through pest scouting. Therefore more selective materials can be used; more selective materials are easier on the beneficials important in biological control of many pests. Therefore, many newer products will fit much better into IPM programs. Many of the new products belong to new groups of pesticides, so called "new chemistry." Having an increased number of chemical groups will also be important in the future in delaying the onset of pesticide resistance.

Increased development of non-pesticidal methods. Both federal granting agencies and private industry are putting more resources into developing alternatives to toxic pesticides. Mating disruption and biological controls are two examples of non-pesticidal practices that will have an increasing role in cranberry pest management in the near future.

New Directions in Cranberry Pest Management

In addition to changes in pesticides, other approaches to cranberry pest management are likely to be more widely adopted in the future.

Insecticides.

Insecticides of the future will be quite different than those of today. How far away is the future? Some of these products are very close to registration, and we should be seeing at least a couple new products for use on cranberry before the end of the 1990s. Many of the new products will have the following general characteristics.

Selectivity. Products will be effective against narrower groups of target organisms and often not harmful to beneficials.

Human risk. Many newer products are much safer to higher organisms, including people. No product will be completely without risk, but some of the newer products come amazingly close to that level of safety. Table 2 compares the relative mammalian toxicity of currently registered cranberry insecticides to two products that will likely be registered for use on cranberry within the next couple of years.

Table 2. Approximate mammalian toxicity expressed as oral LD_{50} values (milligrams of toxicant per kilogram of body weight) (the higher the value, the less toxic the material).

Product	Oral LD_{50}
Diazinon	66
Guthion	13
Lorsban	380
Orthene	900
Sevin	300
New product A	>5000
New product B	>5000

Environmental safety. Again, because of their greater selectivity, many newer products will be safer to aquatic organisms, fish, birds, and mammals.

IPM compatability. Because of safety towards beneficial insects, some of the newer compounds will be easier to integrate into IPM programs. These will increase the survivorship of naturally occuring beneficials, providing an even higher level of natural pest control.

New chemistry. As stated above, new chemistry provides many advantages, such as greater selectivity and increased opportunities to delay the development of resistance. Whereas the majority of current cranberry insecticides are in only one chemical group, the organophosphates, newer products under review belong to close to 10 distinct chemical groups with different types of pesticidal activity. However, it remains to be seen how many of these actually end up registered for use against cranberry pests.

Mating disruption.

Mating disruption involves the use of synthetic insect pheromones to mask the scent of the female moth, thus keeping the males from finding and mating with the females. Females are unable to lay eggs. Where it works, this is an effective form of pest control because it completely blocks the damaging larval stage. Research on mating disruption of blackheaded fireworm is nearing completion, and the results are promising. Although it may not be a complete cure, especially for very high populations of BHFW, it appears that this technique will have a very important role in cranberry IPM. Because BHFW is one of our major cranberry pests, it often dictates the direction of pest management. If we could replace much of the usage of broad spectrum insecticides by more target-specific approaches such as mating disruption, a significant benefit would be the preservation of naturally-occurring biological control organisms. For more information on mating disruption, see the three articles on this subject in the 1997 *Wisconsin Cranberry School Proceedings.*

Biological controls.

Biological control is defined as the use of living organisms for killing pests. These organisms can be those that occur naturally in cranberry beds, or those that can be purchased from companies who mass produce these beneficial organisms. For more background information on biological control, see my article in the 1992 *Wisconsin Cranberry School Proceedings.* Since that article was written, there has been much research on biological control of cranberry pests. Some of the more promising approaches to biological control are summarized here.

Insect parasitic nematodes. Research in the Pacific Northwest has found a new species of insect pathogenic nematode that performs well under cool conditions. *Heterorhabditis marelatus* has been shown to have up to six weeks of residual activity in cranberry soils and provide up to 95% control of cranberry girdler, which is outstanding. Research is currently underway to develop mass production techniques.

Some growers in Wisconsin are currently using nematodes that are already commercially available for cranberry girdler control. These include the species *Heterorhabditis bacteriophora* and *Steinernema carpocapsae.* Research also continues around the country to find nematodes effective against our species of white grubs, but as of yet there is nothing promising to report.

Microbial pesticides. Microbial pesticides based upon the bacterium *Bacillus thuringiensis* continue to be improved. Whether or not there will ever be a product that is excellent against blackheaded fireworm remains to be seen. Current products are marginally effective against BHFW, and these materials have to be precisely applied to maximize benefits. However, the products are highly effective against spanworms when applied when the larvae are young. If spanworms are the sole target pest, the use of a Bt product would help conserve beneficial natural enemies.

A new microbial insecticide based upon the fungus *Beauveria bassiana* is now registered for use on cranberry. However, there are few data at this point to determine its effectiveness against various target pests. With a grant from the Cranberry Institute, we are investigating the possible use of this product against the larvae of cranberry tipworm.

In addition to microbial insecticides, plant pathogens have also been developed as weed control agents. These are frequently called mycoherbicides. Research at the University of Wisconsin and elsewhere has shown that a type of *Alternaria* fungus is very effective for dodder control when applied as a pesticidal spray. This product appears to be close to commercial availability.

Parasitic insects. Many types of tiny stingless parasitic wasps are important natural enemies of many agricultural pests. For example, our research has shown that a complex of four wasp species attacks cranberry tipworm. Although parasitism rates are not high, these wasps do contribute to the substantial amount of natural mortality of tipworm larvae.

Trichogramma wasps are very tiny parasites of insect eggs. The wasp larva lives inside the egg of its host insect and kills it before it hatches. Several species of *Trichogramma* are commercially available and widely used on a variety of crops. Some of these have been evaluated several times in cranberry, specifically for control of cranberry fruitworm, unfortunately without satisfactory results. However, researchers in the Pacific Northwest have discovered a species that naturally attacks the eggs of blackheaded fireworm. In field release studies, *Trichogramma sibericum* shows good promise in helping to control BHFW. Research is currently underway to improve mass production technology. Once this parasite becomes more

readily available, we plan to test it here in Wisconsin against BHFW, cranberry fruitworm, and sparganothis.

Host plant resistance.

Thus far, relatively little work has gone into developing cranberry cultivars that are resistant to insect or disease pressures. Research in Dr. McCown's lab on inserting Bt genes into cranberry for control of Lepidoptera has been moderately successful, but there are still some substantial constraints to implementation. Relatively little work has gone into conventional breeding programs for improved plant resistance. However, we are aware that some cranberry plants tend to be less susceptible to certain insects and diseases than others. Perhaps in the future we may see the development of resistant plants, either through conventional breeding or by genetic engineering.

Transitions in Cranberry Pest Management: How Will the Industry Cope?

There appear to be many changes in pest management on the horizon. Some will be forced on us by regulatory issues. Some will be provided to us as new tools developed by university, governmental, and private research. How will the cranberry industry cope with upcoming changes? Very well, I think. The cranberry industry has some unique strengths to draw on during changing times.

Widespread adoption of IPM The cranberry industry is recognized as a national leader in the adoption of IPM practices. Very few other commodities are so heavily scouted by trained IPM personnel. And growers are already using a diversity of tactics for pest management, including cultural controls such as sanding and biological controls.

Research support. The cranberry industry has an outstanding history of supporting pest management research. Although it is impossible to do all research in all states, research and extension people network very well, allowing advances in one state to be implemented in another. Continued support of research will be critical to develop, evaluate and implement new methodologies.

Adoption of new technologies. Many cranberry growers are progressive farmers very willing to evaluate new technologies as they become available. This allows the industry to continue to stay in a leadership role in the adoption of evolving IPM practices.

Making The Transition

My best advice for making the transition is for the industry to continue to do what it has already been doing well. IPM monitoring practices must be continued so that appropriate pest management decisions can be made on what is actually happening in the beds. Stay informed of new developments. As new products and pest management practices become available, growers should evaluate how these work on their own farms. In that way you will have experience with newer materials if older products are lost.