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INTEGRATED PEST MANAGEMENT—THE NORTHEAST US EXPERIENCE

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Integrated Pest Management (IPM) is a fundamental component of Sustainable Agriculture. With a history of some 20 years, most IPM programs in the US have evolved to emphasize the use of bio-intensive methods. These methods include the use of biological control agents, resistant plant varieties, semiochemicals, and physical and cultural methods of managing pests. Their use builds upon previously developed IPM methods such as pest forecasting, pest monitoring, and the use of thresholds. These methods, together with pesticides, represent the current set of tools available to farmers and growers to help them combat pest problems.

The educational methods used to acquaint growers and farmers with IPM methods are very diverse, varying from one-on-one counseling sessions to coaching through computer software. In New York and in several other northeastern states, small farmers and growers have formed their own pest and crop management organizations to provide for IPM services and advice. This paper will share the experiences gained in the development of the applied research and extension aspects of the IPM Program in New York.

The IPM Program is part of the sustainable agriculture approach at Cornell and is the result of the efforts of some 80 scientists in 14 departments, combined with the efforts of nearly 40 Extension Specialists in the Cornell Cooperative Extension system. Participation in this multidisciplinary effort is encouraged through a grants program drawing upon resources provided by state, federal, college, and grower sources. The largest source of support is nearly one million dollars and comes from the state. The goal of the program is to reduce pesticide use to the minimum level necessary to protect the health of all citizens and the environment, while still keeping our growers and farmers competitive. Pesticide reductions are regularly occurring in New York as new knowledge is developed and demonstrated to farmers.

Our experience in the application of IPM methods indicates that the greatest success is achieved when these methods are used in concert with one another. Reliance upon one or two of these methods as the answer to managing pests will only lead to continuing problems

Our experience with biological control agents has been particularly successful in the management of insects using parasites and predators. That success varies from crop to crop, with the greatest success occurring in field and forage crops, where pesticide use is low. In horticultural crops the success rates has been lower because pesticide use tends to be higher. Among the most promising applications to date is the use of natural enemies to suppress the diamond-back moth and the European corn borer in vegetables and spider mites in fruit crops. One of our most effective demonstrations is the application of a parasite to control flies in dairy barns. Large-scale demonstrations are underway on nearly 60 dairy farms this year. The biological control agent is purchased from a manufacturer and released in dairy barns using a cheesecloth bag. This method is combined with proper removal of manure, the use of indigenous beneficials, and the proper selection of pesticides.

Biological control using pathogens has again proved to be most successful in the management of insects. Some of this is due to the fact that the major agri-chemical companies have begun regular production of these agents. Biological control of pathogens and weeds is still primarily in the research phase, but we expect to see some applications in the next few years.

Our experience in the application of cultural methods includes the use of plant structures to minimize pest sanctuaries.

This is best illustrated by the application of Y-trellising to apples trees, which exposes the center of trees to sunlight and removes pest refuges. In the management of the Colorado potato beetle, New York growers have turned to trenching around the overwintering sites of the beetle. These trenches capture nearly 85% of the overwintering beetles as they crawl toward the host crop. This method, along with the use of propane burners to burn potato beetles as they attack emerging plants, are just some of the cultural methods being adopted by growers. Some success has been noted in applying cultural methods to pathogen and weed management, with crop rotation, and cultivation being the most successful.

The practical application of semiochemicals (pheromones, host plant odors, etc.) has been most successful in our grape vineyards, where the pheromone of the female grape berry moth is applied using plastic twist-ties to hold the grape vines to the wires. This creates numerous attractive odor sources for the male moths and essentially confuses them as they attempt to locate a female.This application provided most grape growers the opportunity to eliminate insecticide applications.

The application of host plant resistance methods has been very successful in apples, where new varieties are resistant to five major pathogens and offer the potential to eliminate 45 pounds per acre of fungicide use. Nearly one dozen of these varieties are now available but grower adoption is slow due to a lack of recognition of and, thus, demand for these varieties in the marketplace. Breeding efforts have also produced potatoes, cucurbits, field crops, and other vegetable varieties that are resistant to attack by insects, nematodes, and pathogens.

The recent emphasis on bio-intensive methods has created an increasing need to bring each of the cropping systems into biological balance. This balance has been very difficult to achieve because there are so many pesticides that often need to be used for a multitude of pests. When a pesticide is used, it often disrupts the balance we are looking for. Thus we have had to carefully study the impact of all available pesticides in order to document their impact on biocontrol agents. This has led us to begin to indicate the least toxic chemical choices to our farmers. The application of least-toxic pesticides has been most successful where we have used summer oils for mite and insect management and bicarbonates for pathogen management. Perhaps more exciting has been the application of the Environmental Impact Quotient (EIQ) model (1) to the selection of pesticides. The application of this model to different cropping systems now provides our growers with an opportunity to select the least environmentally damaging pesticide. This model is derived from data taken from the EPA pesticide registration process and from information in several pesticide databases. The model ranks pesticides on the basis of their impact on farmworkers (pesticide applicators and pickers); on the consumer, by using residue and groundwater information; and on other elements in the agricultural environment, such as fish, birds, bees and beneficial organisms. This model now provides for an evaluation of the various cropping systems and the impacts of the various pest management methods used in those systems. For example, the application of this model to five different pest management systems employed on cabbage shows that the conventional system has the highest environmental impact but has the least economic impact on the growers. The organically managed system had the lowest environmental impact. Interestingly, in applying the model to the apple system in New York we learned that the organically managed system had the highest environmental impact.

Delivering IPM knowledge to farmers and growers is the most crucial step in the IPM adoption process. We have developed numerous methods for this delivery, three of which are highlighted in this paper. In the early years of IPM technology transfer, IPM methods were demonstrated to growers as they were developed. Today the approach has shifted to the demonstration of as many methods as possible, in what is termed "multidimensional" demonstrations. Thus a demonstration project of IPM on cabbage today will include methods for managing weeds, insects, and pathogens, perhaps even foraging wildlife. The project will incorporate almost all IPM methods mentioned earlier. This approach is much more holistic and often easier for a grower to comprehend than is the demonstration of different methods over several years.

A second form of delivery has been through our Tactical Agriculture Team (TAg) approach. Farmers and growers together with agribusiness personnel and credit and banking personnel meet at key times during the growing season to assess the pest pressures on various crops. The teams are instructed in pest management methods, conduct their assessments of two different fields, and have their assessments critiqued by IPM specialists. This experiential learning setting has proven to be quite popular with growers, who often conduct a portion of the instruction session. We have been able to measure the impact of this educational effort through the use of preseason and postseason written exams. Test results usually show marked increases in grower's and other team members' knowledge of managing pests.

The third form of delivery of IPM knowledge springs from many of the IPM pilot projects, which demonstrate IPM methods to growers. All IPM projects have a timetable that calls for a phasing out of government support after several years. As this has happened we have observed growers meeting together and eventually forming Crop Management Associations to continue the IPM services. The growers invest in their own organizations and secure the services of a field manager, who provides crop and pest management services and advice. Start-up funds from the IPM program are usually available for the first year, and our experience has been that these organizations quickly become self supporting. Two crop management associations currently exist in New York. They were developed through the efforts of about twenty growers but now enroll 172 small farms with 42,000 acres of crop land. These nonprofit organizations have become one of the best forums for delivery of IPM knowledge.

As we look toward the future we see a continuing need for IPM programs. The resistance of pests to pesticides, increasing regulations, food safety concerns, increasing environmental concerns, and the loss of pesticide labels will continue to generate a great demand for IPM.

However, it appears that IPM approaches will continue to generally remain more costly than conventional pest management, will not always be as "reliable" as a pesticide, and will require more of the management time of a grower.

In summary, it has been our experience that the transition to IPM is a slow process, one which requires innovation in both research and extension. The application of methods continues to require validation, especially as we introduce alternatives to pesticides. This means that we still need a major commitment of resources if the goal of an integrated management system for pests is to be adopted by growers and farmers.

REFERENCES

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