STATUS AND STRATEGIC RESEARCH CHALLENGES IN COCOA AND COFFEE PEST MANAGEMENT

by
Dr. Julie Flood
CABI Bioscience

Pests and diseases are key constraints to both coffee and cocoa production. I cannot, in the time available, give you a full account of all the diseases and pests that attack these crops, so I shall just briefly consider a few of these.

For cocoa, black pod (*Phytophthora* spp) causes an estimated 44 percent loss of the world's cocoa production. CSSV causes 11 percent of all global cocoa crop loss. Mirids or capsids affect 25 to 30 percent of the national acreage in Ghana alone, giving annual losses estimated at 100,000 tons. Africa is the center of diversity of coffee, thus there are many pests and diseases that affect production. Coffee berry disease (*Colletotrichum kahawe*), coffee rust, bark disease and *Fusarium* wilt are examples of some serious coffee diseases. Root mealy bugs, white and yellow stem borers, *Antestia*, coffee berry borer are a few examples that cause serious losses to coffee production annually. *Fusarium* wilt I mention here as an interesting disease. It has reappeared recently after being considered for decades as a minor disease. This disease has now devastated thousands of hectares in the eastern region of the Democratic Republic of the Congo and is spreading in Uganda, where it is now a serious threat to production.

Thus, there are many constraints to production in terms of pests and diseases. Currently, the management of these pests and diseases involves three challenges:

Technical: Pests and diseases are difficult to control with present methods. Also, there is pressure from industry and consumers to find alternatives to pesticides.
Economic: Many farmers cannot afford the management of pests and diseases due to low commodity prices and the removal of subsidies.
Implementation: With shrinking agricultural services, privatization and the growing number of small holders, there is less capacity to train farmers in sustainable pest management.

With regard to economics, we all know that small holder farmers in Africa face enormous economic constraints, i.e., lack of credit and low prices, but for the purposes of this talk I shall concentrate on technical and implementation problems.

Technical Challenges

Currently, control as far as the small holder farmer is concerned, tends to be a mixture of cultural practices and chemical control, which is usually based on copper fungicides (diseases) and some persistent insecticides. The use of these methods assumes that the farmers have some cash or credit to buy these pesticides. There have been some attempts at breeding pest and disease resistant crops, but the vast majority of small holder farmers have no access to this technology. Their management is still based on

cultural practices and chemical control, if they can afford it. Thus, largely, current management practices equal cultural control and chemical control.

Sometimes these approaches are effective, while at other times they are ineffective. Spraying regimes are not adequately conducted and the sprays have to be repeatedly sprayed to be effective. Then there are the problems of environmental contamination. Therefore, the challenges for the future are to produce more effective, environmentally-sound alternatives that are suitable for small holders. What are these measures likely to be? What is the likely strategy for the future? I believe a more holistic approach to the management of these problems is the right strategy – one that involves several components. Broadly outlined under the following headings:

- **Cultural practices**
- **Plant Resistance**
- **Biocontrol**
- **Chemical control.**

Specific cultural controls for specific problems are likely to remain the foundation for pest and disease management. It has long been known, however, that some particular factors, such as shade and the diverse ant communities in cocoa, have both positive and negative effects on different pests and diseases. Thus, if we are to adopt a more holistic approach to management we will need to understand these complex ecological interactions. Also, while effective chemical control methods have been developed for many pest and disease problems, advances in application technology and a more rational approach should reduce problems of cost, environmental effects and pesticide residues in the crop. Also, novel compounds, such as systemic compounds and those that stimulate the host's natural defenses, will be used more.

The two areas of pest management that will come to be used more and more are in the fields of plant resistance and biological control. Recent cocoa studies have shown wide variation and good inheritance of important, including disease resistance, yield and quality. These results allow the application of more efficient selection methods. In the past, however, breeding activities have suffered from the long period of low prices, and certain programs were even discontinued. It has been estimated that less than 5 percent of the cocoa collections have been used in selection programs. In the future, however, there will be an increased use of selection, screening and breeding for resistance. The current CFC/ICCO/IPGRI project is a good illustration of this trend.

Biological control can contribute to pest and disease management in several ways. Firstly, with a better understanding of local natural enemies of pests and diseases, cultural methods can be improved to conserve and encourage them. Secondly, some local natural enemies can be mass-produced and applied to the crop as alternatives to chemical pesticides. Promising research is underway in Asia, Africa and Latin America on development of biological pesticides for both cocoa and coffee pests and diseases. A possible third approach to biological control comes from the recent discovery that cocoa supports a rich flora of endophytic fungi, which live inside the plant tissues, which may stimulate host defenses. Investigation of these fungi may lead to alternative approaches for management.

Thus, in the future, a more Integrated Crop Management (ICM) approach to these crops will be achieved. Repeated inputs, such as pesticides, will be used less and methods of continuing control, such as plant resistance and biological control, will be used more. There will be some pesticide use, but this use will be on a more rational basis with more thought given to application technologies. In keeping with an ICM approach, the use of novel systemic compounds such as trunk injection of phosphonic acid that act by stimulating natural host defenses rather than the broad spectrum pesticides. However, the main advances are likely to come thorough the use of plant resistance and biological control. Use of improved, more resistant varieties of biocontrol is a cheap and environmentally friendly technology adapted to the needs of the small holders.

Cultural practices will continue to be important. Various studies in west Africa and in South America are realizing the benefit of maintaining diversity within cocoa fields. This diversity confers biological resilience by reducing the impact of pests and diseases. One reason for this is that more diverse habitats will contain more natural enemies of pests, which limit the potential for pest build-up. However, it is also known that some tree species can act as alternate hosts of cocoa pests, i.e., CSSV, so the relationship between diversity and biological sustainability is not straight forward, consequently, the manipulation of shade is not straight forward.

Thus, technically, we face an exciting future with many exciting research components that will bring real gains in the fight against many of these pests and diseases. In the next decade, for example, with the advances in molecular biology, the study of the cocoa genome, breeding for resistance and advances in bio-control plus better targeted chemical control, we will be able to control many of these problems but the question remains: Will the farmers use them?

Implementation

Will the farmers use these new technologies? What if the farmers do not know about these techniques? Often there is considerable reticence by researchers to communicate with extensionists and farmers and vice versa. Also, researchers often complain that they know how to control these diseases, but the farmers don't do as we tell them! These problems are coupled with a shrinking extension service and a larger small holder community for these tree crops. How do we over come this? We need to get farmers motivated and to find out why they should use some methods or management and not others?

Final Challenge – Extension and Training

An innovative approach to this challenge has been to train farmers as pest management experts themselves and to rely more on farmer-to-farmer training supported at local community and governmental levels. In "farmers field schools," farmers learn by observation and experiment about the life cycles of pests and diseases, crop ecology and agronomy, the effects of pesticides, fertilizers, plant variety, etc. The key is to ask why don't farmers do the recommended thing? Is it due to lack of inputs? Or because they do not understand why they are supposed to be conducting the recommendations? Often once they understand why they should do it

assuming they will if they have the necessary inputs available. Also, this is a two way process - farmers know things that researchers don't. By encouraging farmers to experiment and to understand the ecology of their cropping system, many problems can be overcome and often it does not cost anything, in fact, farmers can often save their resources. In a pilot coffee program in coffee in Kenya, a season-long training has been shown to reduce the costs of inputs by 80 percent and has stimulated the farmers to experiment with new ideas and spread knowledge to others.

This is an exciting approach and one that I feel will allow the outputs of research to be implemented by small holder farmers. Also, in addition to pest management this is an approach that lends itself to the promotion of recommendations for quality and as a means for the distribution of improved germplasm.

Conclusions

- Pests and diseases are major constraints to cocoa and coffee production in Africa.

- Managers of pests and diseases face three major challenges namely technical, economic and implementation.

- Future management will stress a more holistic approach of integrated crop management (ICM) using cultural practices, plant resistance, biological control and well as a more rational use of pesticides.

- With regard to the technical problem solving, international co-operative research networks such as the ISCP are the way forward for pest and disease management.

- For such innovations to be successful, however, training and extension are critical so that farmers and extension workers understand the crop ecosystems and implement the recommendations.