Developing a Research Agenda for the Caribbean Food System to respond to Global Climate Changes – Issues in Entomology

Prepared for Working Group Meeting
GECAFS "Research Issues"
19-20 September 2002
UWI, St Augustine Campus
Trinidad

by

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Introduction

Several phenomena – some natural and some manmade - have been identified as contributing to global climate change. Among these are factors such as global warming, El Niňo effect, increase in green house gases (carbon dioxide and methane) in the atmosphere, depletion of the ozone layer, rise in sea level and global rise in temperature. Their effects could be far reaching, and have begun to influence climatic events in the Caribbean. Already storms and hurricanes have increased in frequency and intensity; and rainfall patterns have changed. Sometimes there is too much rain leading to floods, soil erosion and leaching of agricultural chemicals; and at the other extreme there may be drought.

Issues in entomology

Scientists have generally agreed that climate change will occur. The issues are, however, when, where and what will happen and how best can these climate changes be predicted or detected. It has also been accepted that global climate change will affect Agriculture and Food Systems in diverse ways that could mean bountiful harvests or hunger, malnutrition and starvation. In the case of entomology, climatic changes have been associated with changes in the range, population size, and movement of insects (and pathogens) that have led to outbreaks, which have affected agriculture and food systems, in the past. Two well-documented cases of the effects of climate change on the build up and movement of insect populations (and pest outbreaks) are the desert locust (*Schistocerca gregaria*) and armyworms (*Spodoptera* spp.). In the Caribbean context, documentation to show such associations between climate change, insect population build up, movement and pest outbreaks, are few. A good example, however, is the arrival of S. *gregaria* in the Caribbean from the West African coast, in the wake of a tropical storm system in 1988. This was an unprecedented event that was fairly well documented but which the region was unprepared for. Fortunately this very destructive invasive species did not survive to become established in the region. There is speculation that the black citrus aphid T*oxoptera citricidus*, vector of the dreaded citrus tristeza virus, arrived in the Caribbean from South America on air

currents. It is also possible that *Thrips palmi* also arrived on air currents but this too is a matter of conjecture. Trans-boundary pests will inevitably invade our shores from time to time in association with weather systems and we must be prepared to deal with them if and when they pose a problem.

Climate change could also lead to local habitat change and create conditions that are favourable for growth in insect populations, which may in turn trigger outbreaks of varying severity. One group of insects to be considered in this regard is invaders that may remain quiescent only to flare-up to outbreak proportions as favourable ecological and environmental conditions develop. Indigenous or naturalized insects that normally fluctuate at manageable levels may increase to outbreak proportions as climatic conditions become more favorable. Quarantine pests that may or may not be accidentally introduced with their natural enemies may become established and problematic if climate change creates environmental and ecological conditions that are similar to their area of origin.

Whether insects (pests) are invasive or indigenous, crop-pest interactions in the wake of climate change could lead to potentially devastating situation(s) in Agriculture and Food Systems, once insect numbers increase beyond a certain economic threshold. They reduce both food quality and quantity by causing serious economic damage and crop loss in the field, contamination and food loss in storage, and are costly and difficult to manage or control. Since climate change could be unpredictable and could have serious consequences associated with insect population build up, it is important to put mitigation measures in place to deal with the consequences of short-term climatic event(s) or more long-term climate change.

Management strategies

The traditional approach to suppressing most insect pest problems is to increase the use of chemical pesticides, which could lead to serious health and environmental effects such as pesticide poisoning, and environmental contamination. Many options can be explored to deal eventualities in this context. These range from straightforward conventional approaches to adoption of modern biotechnology that would entail complex issues and even policy decisions. Whatever choices are made, the ultimate goal should be to achieve food safety and food security.

Some approaches are presented below for consideration in developing a research agenda on the impact of global climate change on Caribbean Food System in relation to issues in entomology:

- Develop computer-aided models to determine global climate changes that are likely occur that would impact on the Caribbean. These models should anticipate some likely effects on Caribbean ecology and environment so that mitigation strategies can be developed. They should include considerations of shift in production systems to deal with pest situations that may arise through climate change or even accidental introductions.

- Identify the major food system(s) and associated pests or pest-complexes in the Caribbean. Some of this might have already been done under other initiatives but all available information should be pooled.

- Prioritize the pests associated with various systems especially those that could be affected by climate change and develop contingency plans to manage such pests in the event of outbreaks.

- Study pest population dynamics to develop predictive models to determine the potential impact of climate change on pest populations in the region.

- Establish economic thresholds levels beyond which intervention may be necessary; develop and introduce appropriate measures to keep pest populations below these thresholds.

- Strengthen plant quarantine throughout the region, to keep out pests that could be introduced with liberalized trade and which could become established to proliferate with regional climate change.

- Develop and clearly articulate an Emergency Preparedness (Action) Plan for the region to deal with pest outbreaks.

- Further develop and apply the principles of integrated pest management to pest-complexes that exists in the Caribbean Food System.

- Apply indigenous knowledge to pest management, which can first be obtained through research and documentation; find out how farmers deal with pest problems brought on by change in the weather.

- Introduce measures to discourage the use of harmful chemical pesticides and promote the use efficacious yet more environmentally friendly products in the region. Harmonization of pesticide registration and pesticide use should be mandatory for the region.

- Develop and/or adopt technology to introduce insect resistant crops through conventional plant breeding or the use of genetically modified (transgenic) plants that have been developed for resistance to insects, through modern biotechnology. The latter in particular, will depend largely on (regional) policy and the general acceptance of such modified plants as food.

Conclusion

Successful adaptation to future climate change would depend on the regional definition and understanding of what changes could occur, where they would occur and how they would impact on insect populations in the Caribbean Food System. Only when the issues involved are understood can the region develop or adopt strategies to overcome the challenges with which it would undoubtedly be faced. These issues should not be dealt with in isolation, but in collaboration with other agencies that might have interest or are already actively involved in confronting and developing solutions to the problem.

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September 2002