Weather, Climate and Pests and Diseases

Workshop Report

April 4th - 5th 2011

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Caribbean Institute for Meteorology and Hydrology
Husbands
St. James
BARBADOS

Contents

I. INTRODUCTION

The Weather, Climate and Pests and Diseases Workshop took place at the offices of the Caribbean Institute for Meteorology and Hydrology on April 4th and 5th 2011.

The purpose of the workshop was to provide training in pest and disease modelling (more specifically as it pertains to seasonal climate information).

The full agenda is attached at **Annex 1**.

II. REPRESENTATION

Attendees included representatives from the National Meteorological Offices of the ten participating countries and CARDI.

(See full list of attendees at **Annex 2)**.

III. WELCOME AND BACKGROUND - Mr. Adrian Trotman – CIMH

The session commenced with the welcoming of participants to the workshop by the project coordinator, Mr. Adrian Trotman. Mr. Trotman then proceeded to give a brief background of the Caribbean Agro-Meteorological Inititative (CAMI) project.

IV. PRESENTATIONS

Day 1

CAMI Presentation - Adrian Trotman, CIMH

Mr. Trotman gave an introduction to the CAMI project outlining its objective, which is:

> *To increase and sustain agricultural productivity at the farm level in the Caribbean region through improved applications of weather and climate information.*

One of the key aspects of this project is to engage the farming community. Having one or two persons in the meteorological service form a relationship with farmers would help both entities understand each other in terms of what is needed and what could be provided. Training of these Meteorological Services personnel in key aspects of agro-meteorology will also move the dialogue to provision of tailor-made weather and climate information that would facilitate improved on-farm decision making.

Monitoring of Epidemics: disease, pathogens, insect, host – Dr. Simone Orlandini, University of Florence, Italy

Dr. Simone Orlandini of the Department of Plant, Soil and Environmental Science, University of Florence, structured his presentation by looking at plant disease measurements, pathogen measurements, insect measurements and host measurements, before engaging participants in a brief exercise.

Dr. Orlandini stated that field observations of plant disease plays the same key role as diagnosis. It represents the basis for epidemiological studies, assessment of crop losses, plant disease survey, development and application of models, correct management of crop protection, screening of resistance and evaluation of protection methods and other experiments. In general, plant disease must be estimated by human activity, unless there is some equipment that can ensure good measurements with different degree of precision and accuracy.

The observation of pathogens and the estimated severity of their damage require specific equipment and can be useful for pre-season analysis of the risk in soil and seed borne disease. Measurements also allow the evaluation of the dynamics of the disease's spatial variability within a region.

In his presentation Dr. Orlandini also highlighted that the tropics and developing countries are those regions mostly affected by constant crop loss as a result of lack of technologies and high temperatures (two of the causes highlighted).

In the exercise given, participants were to determine the incidence and severity of downy mildew and powdery mildew on a given plant.

Basic Elements of Modelling for Pests and Disease Applications – Dr. Simone Orlandini

In this presentation of modelling for pests and disease, Dr. Orlandini highlighted that in a biological system you can have a large number of elements inter-relating. These elements must be simplified and the most important element identified.

To give a definition of a simulation model it is a simple representation of pest and disease that aims to study infection and damages and to compute responses to the environment. These models can either be descriptive (empirical) or explanatory (mechanistic). The descriptive model defines the behaviour of the system in a simple manner whereas the explanatory model consists of a quantitative description of the mechanisms and processes that cause the behaviour of a system.

The question was asked about how does one work around the lack of station data. Dr. Orlandini's response was to not model everything but give an illustration by modelling something to see how well it works and thus see if it can be applied to the entire country/ other countries.

Application of Agro-meteorological Model to Crop Protection – Simone Orlandini

In his presentation of Application of Agro-meteorological Model to Crop Protection, Dr. Orlandini gave an outline of the input data and hardware needed to acquire them, models used for crop protection, the use and application of such models as well as potential means of dissemination of information (bulletins, cellular).

The presenter pointed out the roles of some of the key meteorological variables on diseases development – solar radiation important for growth, temperature and photoperiod for development, relative humidity and rainfall provides critical free moisture (leaf wetness), and wind supports dispersion. An important part of the presentation was the equipment needed to acquire these measurements, including the technology of remote sensing.

Climate Variability and Impacts on Agriculture (focus in Florida) – Clyde Fraisse, University of Florida, USA

Dr. Fraisse in his presentation, "Reducing Risks in Agriculture: Adapting to Seasonal Climate Variability", by using examples from Florida, emphasized the fact that we need to talk to farmers about what is happening now as well as in the future rather than just looking at seasonal forecasts. Drivers of climate, such as the El Niño/Southern Oscillation and the North Atlantic Oscillation are key elements in determining the nature of seasonal forecasts. These seasonal climate forecasts can be used to forecast potential impacts by diseases and other impacts on vegetation. Dr. Fraisse also highlighted the difference between decision making at the weather and climate scales. Weather forecasts allow for more operational or tactical decisions (e.g. when to plant or spray and irrigation timing and amounts), whilst climate forecasts are used for more strategic decisions (e.g. variety selection, acreage allocation)

In his overview of the climate variability in the South East U.S.A, he states that El Niño phase brings with it a cooler phase as opposed to Belize and the Eastern Caribbean.

Impacts on Agriculture in Florida

- El Niño/La Niña impacts yields with a decrease in tomato yields during an El Niño (due to diseases) and an increase in yields during La Niña. Botrytis disease of strawberry is more prevalent during El Niño phases than during La Niña.
- Hard freezes on crops occurred during neutral years with the exception where there is a weak El Niño and a negative North Atlantic Oscillation (NAO) phase. More wildfires occur during La niña

The presenter also emphasised the importance of looking at the past to see what occurred under certain conditions. Analogue years would be an important determinant in what the potential impacts of the forecasted season could be. He also indicated that opportunities exist for adaptation to climate change.

Agro-Climate-based exercises focusing on specific tools – Clyde Fraisse

Participants engaged in an exercise using agroclimate.org where they were able to play out the potential impacts of El Nino and La Nina events on the climate of specific parts of Florida. The impacts of these ENSO phases and resultant climate on a strawberry disease were also played out.

Day 2

Application of Generic Models: Infection and Degree-Days Model Exercise – Simone Orlandini

In this presentation Dr. Orlandini looked at different modelling approaches – for example Mechanistic and Empirical approaches, as well as the Fuzzy, Neural approaches. Since the mechanistic approach utilises mathematical functions that define the entire pest or disease development system, it becomes more detailed with a greater data demand and may be more difficult to develop. The empirical approach utilises a relationship between one or two parameters with pest/disease development and may be easier to develop and apply in a data sparse region like the Caribbean. Dr. Orlandini pointed out that the disadvantages of the Fuzzy, Neural approach is that it does not give any information about the system but just gives an output. In using a model it is useful to understand the system. The Fuzzy approach however, allows you to use quantitative and qualitative information.

Dr. Orlandini then outlined the use and Application of the Models

- For climatic classifications
- For field monitoring and forecasting for crop prediction
- For future climate scenarios for climate change and variability analysis

When producing information from these models it is important for farmers to know that it is a forecast to support their activity. It is not reality and each farmer would have to adapt the model output to make their own on-farm decisions.

Participants then engaged in an online exercise where they observed leaf infections.

Summary of National Concerns – Anil Sinha, Caribbean Agricultural Research and Development Institute (CARDI)

During December 2010 and January 2011, Dr. Orlandini and Mr. Anil Sinha met with national agriculture (including extension officers) and meteorology officials, farmers and officials from regional agricultural organisatons in seven of the ten CAMI partner countries. These meetings were organised to determine the main national pests and diseases concerns perceived to have some association with the weather and climate conditions. The output from these meetings will help to determine the way forward for the modelling and information-generating exercises for pests and diseases.

A summary of these meetings, including a potential way forward for the CAMI pests and diseases activity, was presented by Mr. Sinha.. From the national dissertations, the following crops and their pests and diseases were determined to be the ones to be pursued in the modelling exercise:

CROP	**PEST/DISEASE**
Banana	Black Sigatoka
Citrus	Asian Citrus Psyllid/ Citrus Greening
Sugar cane	Frog hopper
Pepper/tomatoes	White flies , Anthracnose, leaf spots, Bacterial wilt, Damping Off, Nematodes

Coconut	Red palm mites
Soybean	Asian Soybean Rust (Belize only)

Of these, it was thought that modelling efforts would focus on the following:

- Black Sigatoka
- White flies (prevalent in the dry season)
- Citrus Psyllid
- Asian Soybean Rust (Belize only)

The pest/disease of most importance would be modelled by Dr. Orlandini and Mr. Sinha, along with colleagues from CARDI and CIMH. CARDI has also identified soya bean, grown in Belize a, a

Preliminary Modelling Approaches using Pathogen and Pest Model – Simone Orlandini

Taking a look at a Simple Generic Infection Model for foliar fungal plant pathogens, Dr. Orlandini stated that it is important for this model to identify the inoculation in order to apply treatment.

Participants also engaged in an exercise where they looked at the growing degree days for pest management. The Degree Day model is based on accumulation of temperature between upper and lower thresholds.

Leaf Wetness Estimation: Exercise – Simone Orlandini

Participants were presented with several methods that can be used to estimate leaf wetness duration. These included:

- Constant Relative Humidity Threshold
- Dew Point Depression
- Extended Relative Humidity Threshold

The first and third methods considers thresholds of relative humidity as the determining factors for leaf wetness duration for pests/diseases development, whereas in the Dew Point Depression method the degree of depression will be the basis on which leaf wetness duration will be estimated. It has to be determined which of the three methods will be most appropriate for the Caribbean region.

The exercise conducted was to obtain the best approach for estimation of leaf wetness duration of the black sigatoka.

V. Workshop Summary – Adrian Trotman

In his summary of the two-day workshop, Mr. Trotman highlighted the activities for the way forward. He stressed that the models to be developed or adapted for the region will be supported with the necessary data from the region, including meteorological and biological data. Mr. Trotman also stated that relationships need to be fostered to determine if what we are seeing in the models is actually what is happening in the field. This is important in utilising relevant models. CARDI and CIMH will be supported by Dr. Orlandini in the development and/or adaptation of the models.

VI. ANNEXES

Annex 1

Caribbean Agro-meteorological Initiative (CAMI)

Weather, Climate and Pests and Diseases
4-5 April, 2011
Caribbean Institute for Meteorology and Hydrology
Husbands, St. James
Barbados

DAY 1

Time	Topic	Speaker
9:00-9:10	Welcome and Background	Adrian Trotman
9:10:9:40	CAMI Presentation	Adrian Trotman
9:40-10:10	Monitoring of epidemics: disease, pathogen, insect, host	Simone Orlandini
10:10-10:40	Basic elements of modelling for pest and disease applications	Simone Orlandini
10:40-11:00 Break		
11:00-12:00	Application of agro-meteorological model to crop protection	Simone Orlandini
12:00-12:30	Generic models for pests and diseases.	Simone Orlandini
12:30-1:30 Lunch		
1:30-2:00	Climate variability and impacts on Agriculture (focus on Florida)	Clyde Fraisse
2:00-3:00	Decisions under the context of weather and climate (tactical and strategic decisions), engaging producers to discuss climate at different time scales	Clyde Fraisse
3:00-3:15 Break		
3:15-4:45	Agro-Climate-based exercises focusing on specific tools	Clyde Fraisse

Caribbean Agro-meteorological Initiative (CAMI)

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Day 2

Time	Topic	Speaker
9:00-9:10	Introduction to Day 2	Adrian Trotman
9:10-10:10	Application of generic models: infection and degree-days model exercise	Simone Orlandini
10:10-10:40	Summary – National Concerns	Anil Sinha
10:40-11:00 Break		
11:00-11:30	Regional Approach	Anil Sinha
11:30-12:00	Analysis of possible role of agro-meteorological models	Simone Orlandini
12:00-12:30	Definition of modeling aims	Simone Orlandini
12:30-1:30 Lunch		
1:30-2:30	Leaf wetness estimation: exercise	Simone Orlandini
2:30-3:00	Preliminary modeling approaches using pathogen and pest model: black sigatoka example	Simone Orlandini
3:00-3:15 Break		
3:15-4:00	Preliminary modeling approaches using pathogen and pest model	Simone Orlandini
4:00-4:30	Wrap-up and Workshop Summary	Adrian Trotman

Annex 2

	Pest Management Workshop		
	Participants List		
	Last Name	First Name	Organisation
1	Aaron	Arlene	Trinidad Met Services
2	Agard	Lisa	CIMH
3	Descartes	Venantius	St. Lucia Met Services
4	Destin	Dale	Antigua & Barbuda Met
5	Forde	Michael	BAS
6	Fraisse	Clyde	University of Florida
7	Hall-Hanson	Rasheeda	CARDI
8	Holder	Keeley	BAS
9	James	Michael	MOA
10	Kirton-Reed	Lisa	CIMH
11	Marcellin	Vernie	Dominica Met Service
12	McDonald	Joan	Airports Department
13	Mitchell	Cecil	Grenada
14	Moore	Anthony	CIMH
15	Nurse	Sonia	Barbados Met Services
16	Orlandini	Simone	University of Florence
17	Singh	Narita	Guyana Rice Development Board
18	Sinha	Anil	CARDI
19	Spence	Jacqueline	Jamaica
20	Stefanski	Robert	WMO
21	Stoute	Shontelle	CIMH
22	Taylor	Bret	MOA
23	Tench	Frank	Belize Met Service
24	Thomas	Carol	IICA
25	Trotman	Adrian	CIMH
26	Waldron	Peter	BAS