Developing sustainable disease management strategies to improve vegetable production towards self-sufficiency and food security in the Caribbean Region

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ABSTRACT

The plant disease constraints of model vegetable crops (tomato, cowpea/bodi and pumpkin) will be investigated in the field and laboratory by quantifying disease prevalence and developing diagnostic tools and integrated disease management (IDM) practices. These practices will be transferred to growers in the southern Caribbean region through the respective government ministries via training of farmers and agricultural personnel. Adaptation of new disease management practices will substantially reduce the disease incidence and over-dependence and use of chemical fungicides and thereby minimize the crop production costs and maximize profits to farmers. It would also minimize the accumulation of toxic chemical residues in the environment.

OUTLINE OF ACP-EU PROJECT

Study of Prevalence of Crop Diseases through disease surveys and setting up of trial trap plots

Extensive disease assessment surveys incorporating field inspections, scouting, farmer interviews and pre-designed questionnaires were conducted and completed in Trinidad, Guyana and St. Vincent and the Grenadines. Data was collected on crop varieties, soil fertility/nutrient capacity, irrigation facilities, usage of fertilizers and manures, fungicides and pesticides, bio-control agents, bio-fertilizers, phyto-booster products, facts on disease incidence, pest infestation, nutritional disorders, post-harvest damage, yield, produce quality, produce price and economics of production. Specimens were collected and disease symptoms were characterized and every stage of symptom development.

Development of tools and techniques for early and efficient diagnosis of plant diseases

Tools and techniques for early diagnosis were developed using classical laboratory studies using cultural characteristics, morphological features and advanced DNA-based methods. DNA was extracted from more than 40 pathogen isolates and sequencing will be performed to deduce the nucleotide sequences of rDNA or genomic DNA targets to identify the pathogens. A research laboratory was established at UWI exclusively for conducting this research.

OUTLINE OF ACP-EU PROJECT

Development of Integrated Disease Management (IDM) practices for field cultivated tomato, bodi and pumpkin

This objective involves extensive field experimentation of identified control measures and cultivation methods for tomato, bodi and pumpkin at multiple locations and seasons. The control measures encompass cultural, nutritional, chemical, biological, non-conventional, and integrated models. These trials are ongoing at ten field plots in Trinidad and five each in Guyana and St. Vincent in all the three crops. Data on disease incidence, crop growth, yield and quality of produce are being assessed during the trials.

Development of varietal collection bank for tomato, bodi and pumpkin

A varietal collection bank for selected vegetable crops including tomato, pumpkin and cowpea is to be developed for the purpose of preserving the local germplasm and to import elite lines from other tropical countries utilized for future disease resistance screening. Paperwork has been finalized and drafts have been sent to collaborating institutions.

Promotion of technology, skill and knowledge transfer and outreach

Workshops and field demonstrations providing theoretical and practical knowledge on disease identification, assessment of disease and pathogen isolation in the field are being organized for agricultural research and extension personnel. Manuals and Brochures displaying symptoms of important diseases of selected crops have also been prepared and distributed to farmers.

Survey of Disease incidences in Trinidad, St Vincent and Guyana

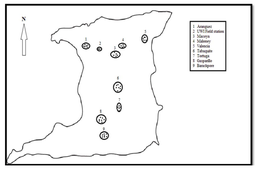

Fig 1a. Survey of Disease incidence in Trinidad (circled spots are locations)

Fig 1b. Survey of Disease incidence in St. Vincent (location in blue)

Fig 1b. Survey of Disease incidence in Guyana (location in red)

Rate of application for Fertilizers, Insecticides and Fungicides in Trinidad

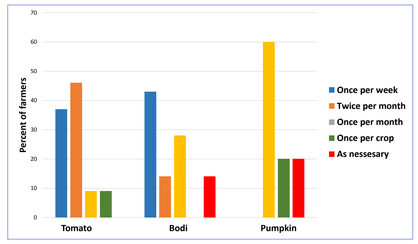

Fig 2. Rate of fertilizer application per crop in Trinidad

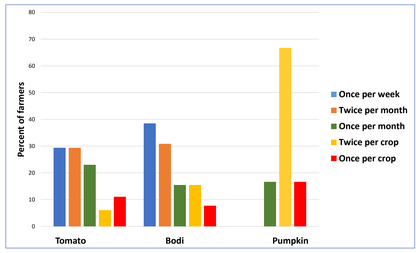

Fig 3. Rate of insecticide application per crop in Trinidad

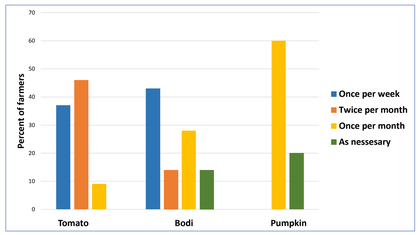

Fig 4. Rate of fungicide application per crop in Trinidad

Table 1. Diseases observed in tomato, bodi and pumpkin

Disease name	Causal organism	Transmitted by
	Tomato	
Wilt	*Fusarium oxysporum f.sp. lycopersici*	
Stem rot	*Sclerotium rolfsii*	
Early Blight	*Alternaria solani*	
Septoria leaf spot	*Septoria lycopersici*	
Bacterial spot	*Xanthomonas campestris pv. vesicatora*	
Tomato Mosaic Virus	Tobamo virus	Mechanical
Leaf curl virus	Nicotiana Virus	White fly
Tomato spotted wilt virus	TOSPO virus	Thrips
Root knot nematode	*Meloidogyne* sp	
	Cowpea (Bodi)	
Rust	*Uromyces vignae*	
Cercospora leaf spot	*Mycosphaerella cruenta*	
Powdery mildew	*Microsphaera diffusa*	
Anthracnose	*Colletotrichum lindemuthanium*	
Bacterial leaf blight	*Xanthomonas vignicola*	
Cowpea mosaic virus	Comovirus	Aphid
	Pumpkin	
Downy mildew	*Pseudoperonospora cubensis*	
Anthracnose	*Colletotrichum orbiculare*	
Powdery mildew	*Erysiphe cichoracearum* *Sphaerotheca fuliginea*	
Gummy stem blight	*Didymella bryoniae*	
Pythium fruit rot	*Pythium ultimum*	
Phytopthora fruit rot	*Phytopthora capsici*	
Angular leaf spot	*Pseudomonas syringae pv. lachrymans*	
Cucumber mosaic virus	Cucumovirus	Aphid

Prevalence of disease in Tomato, Bodi and Pumpkin from surveyed fields in Trinidad

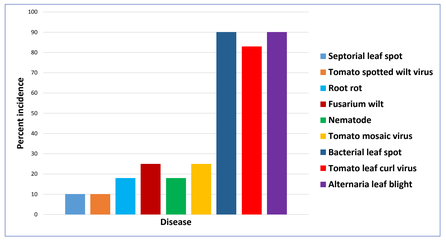

Fig 5. Prevalence of Tomato diseases in Trinidad

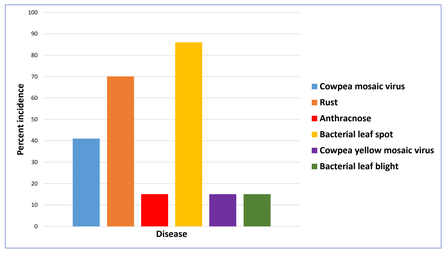

Fig 6. Prevalence of Bodi diseases in Trinidad

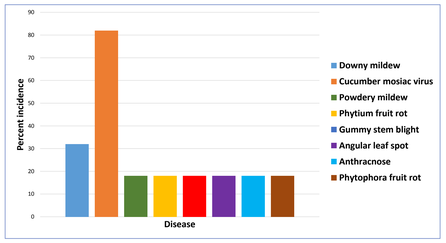

Fig 7. Prevalence of Pumpkin diseases in Trinidad

SUMMARY OF PROGRESS

Disease assessment surveys were completed for Trinidad, Guyana and St. Vincent. The disease incidences and disease symptoms in tomato, bodi and pumpkin were recorded for each country and pathogens were identified.

Pathogens from disease samples were isolated and culture collections are being established. Trap-plots were established. A Plant-Microbe Research Laboratory was established and dedicated for this project at the Department of Life Sciences, UWI-STA.

Classical (cultural characteristics and morphological features) and advanced DNA-based methods were developed for important pathogens of target crops. DNAs were extracted from representative pathogen isolates and used for developing PCR based detection and characterization techniques.

Research field experiments were laid out in the above crops for developing Integrated Disease Management methods. Institutions within the partnering countries and abroad have been contacted for obtaining elite crop lines to develop a crop collection bank at UWI-St.A. Trainings on disease identification and assessment were conducted at three locations.

ACKNOWLEDGEMENTS

The University of the West Indies
Ministry of Agriculture, St.Vincent & the Grenadines
NARI Guyana
Ministry of Food Prodn. Trinidad and Tobago
University of Guyana
Tamil Nadu Agricultural University India
Annamalai University India
AVRDC The World Vegetable Center
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UWI-Plant-Microbe Group

Presented at Department of Life Sciences Annual Symposium, March 2014