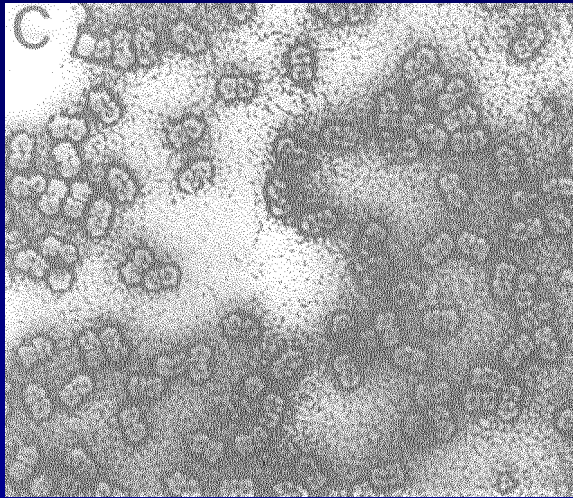


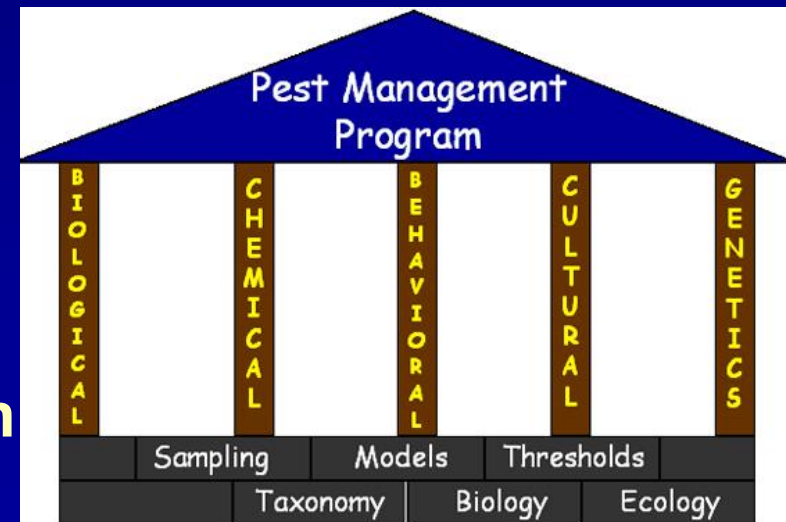
Prevalence and success of host-free periods for managing tomato-infecting whitefly-transmitted geminiviruses (begomoviruses) in developing countries



Robert L. Gilbertson
Department of Plant Pathology
University of California-Davis

Integrated Pest Management (IPM) of Insect-Transmitted Plant Viruses

- “ An approach that **combines multiple management strategies** (e.g., biological, chemical, cultural, genetic and physical) selected based on **knowledge of the biology of the virus(es)**
- “ Goal is **efficient management with minimal inputs of pesticide; economically and environmentally friendly**
- “ Three basic steps:
 1. **Correct pathogen ID**
 2. **Understanding pathogen biology/ disease epidemiology**
 3. **Development and evaluation of an integrated management strategy**



Once identified: Understanding the biology of the virus is necessary for effective disease management

ÉBiology of the virus

(host range, mode of transmission, etc.)

ÉBiology of the insect vector

(host range, population dynamics etc.)

ÉInsect-virus interaction

(mode of transmission)

ÉSources of inoculum

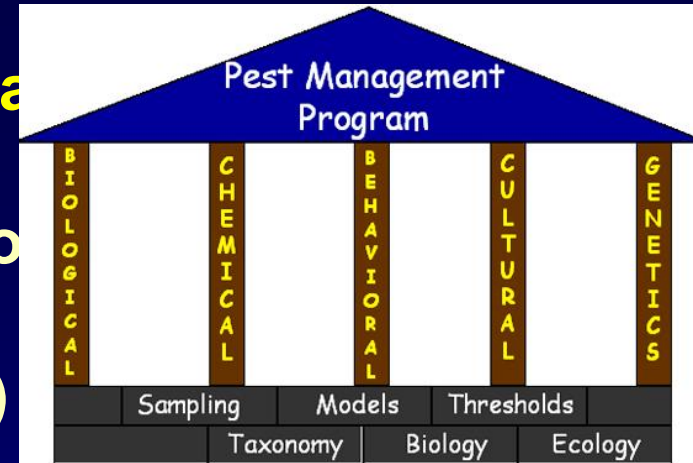
- seed
- weeds/other reservoir hosts
- old crops
- insects

ÉMeans of survival in the absence of the economic hosts



Pest management strategies based on knowledge of the biology of the virus

- regulatory (do not introduce exotic pathogens/in seeds and transplants)
- avoidance (field location, planting dates)
- disease resistance (conventional and transgenic)
- pathogen-free propagative materials (seeds and transplants)
- protection (screenhouses, greenhouses, row covers)
- disease monitoring and forecasting
- vector management (insecticides)
- removal of diseased plants (roguing)
- sanitation (harvested crops, weeds, volunteers)
- crop rotation
- host-free periods



What is a host-free period?

LA means of breaking continuous cropping patterns through a **defined period of time where a susceptible crop(s) are not grown**, resulting in the 'cleansing' of virus inoculum from the agroecosystem



É In temperate regions the winter can provide a natural host-free period

É Best suited to **annual crops harvested over a short period** (e. g., vegetables and cotton)

É **Nature of the host-free period** (e.g., time of year, length, crops involved, area) will depend on crop, cropping system, and virus-host and virus-vector interaction

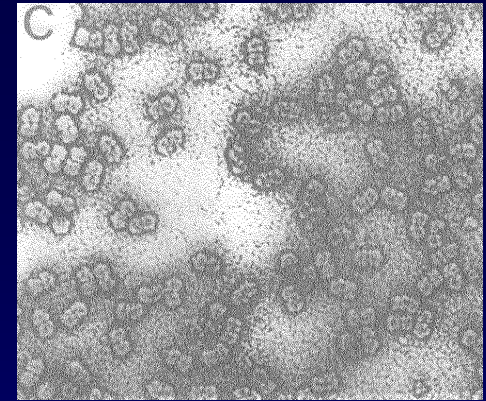
É Must be done along with **extensive sanitation**

É Can be **legally enforced or voluntary**



What make a host-free period for management of whitefly-transmitted geminiviruses (WTGs)

- É Not seed-transmitted
- É Tend to have **narrow host ranges** (i.e., most important inoculum source is the crop plant itself)
- É Whiteflies have relatively **short (~30 day) life cycles** and WTGs are **not transovarially transmitted**
- É Many economically important diseases caused by WTGs are in **annual crops** (cotton, cucurbits, peppers and tomatoes)
- É Thus, a **2-3 month host-free period** can be a very effective and sustainable management strategy for WTGs and **can also reduce whitefly populations**



Small ssDNA viruses
WTGs in the genus *Begomovirus*



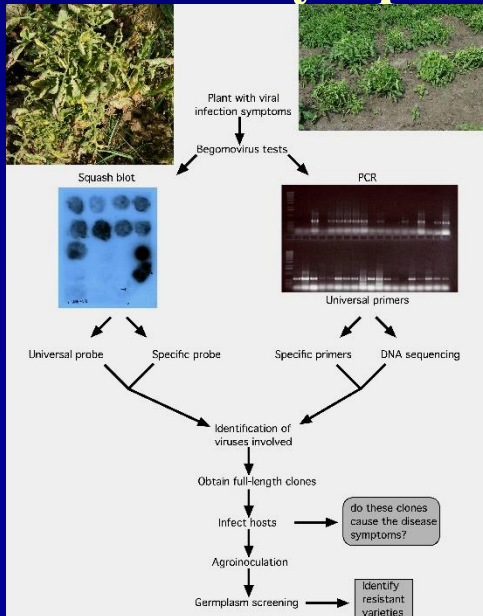
the host-free emergence of

WTGs in West Africa

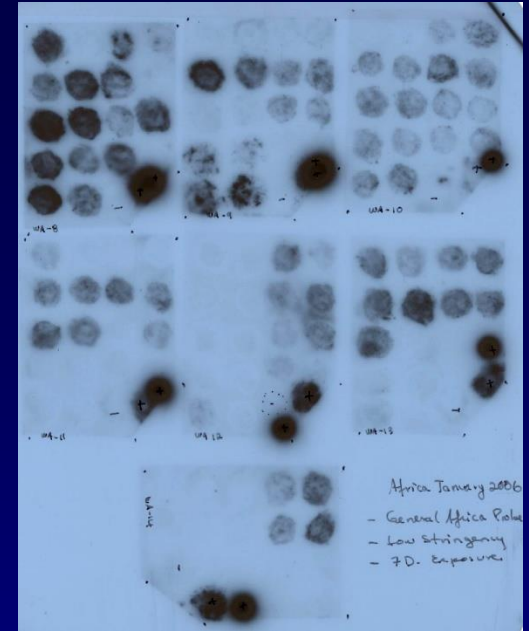


WTGs have emerged as a major constraint on tomato production in West Africa

Molecular characterization has revealed a complex of at least 5 locally evolved monopartite begomoviruses and one or more betasatellites causing symptoms of leaf curl, yellow leaf crumple and a severe symptom phenotype



Could be part of an IPM complex of WTGs in West Africa?

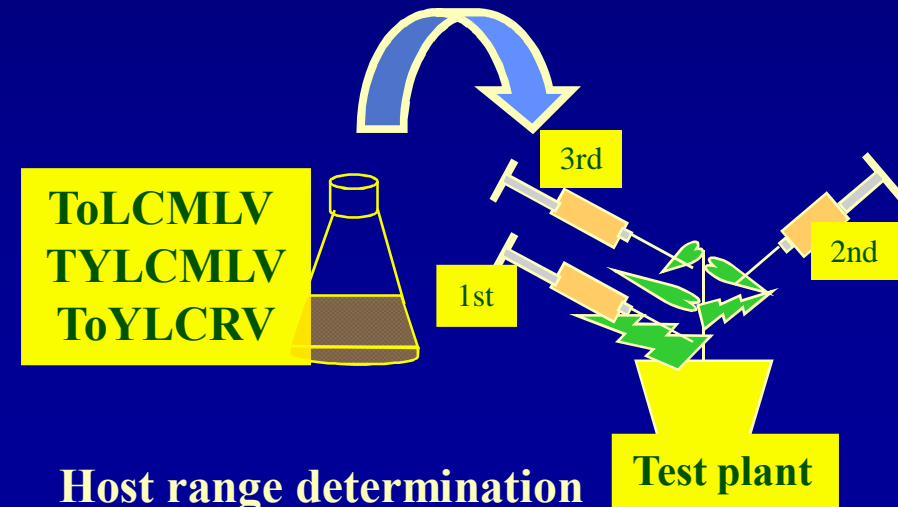


Squash blot hybridization for begomovirus detection

É Squash blot (SB) hybridization and SB-PCR tests of crops and potential hosts suggested that the West African tomato WTGs have a narrow host range

É Host range studies performed with infectious clones of four of the begomoviruses supported these results and indicated that tomato and tobacco were hosts

É Taken together with the other known biological parameters of WTGs, this suggested that a host-free period could be an effective management strategy



Host range determination by agroinoculation

of the host free period in the Baguineda irrigated rice-vegetable perimeter

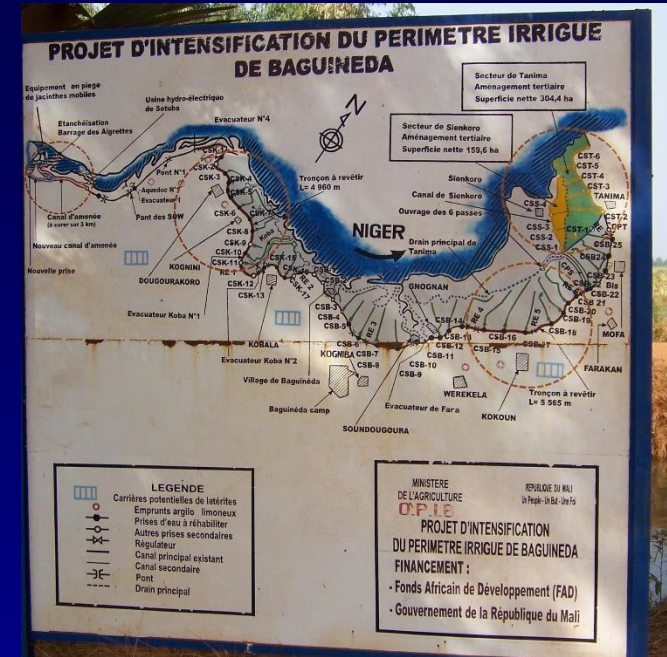
ÉThe Baguineda irrigated rice-vegetable
perimeter was selected as a test site

ÉThis location was so severely impacted by
WFGs that tomato production had been
abandoned

ÉThe rainy season months (June-August)
were selected for implementation of the
host-free period

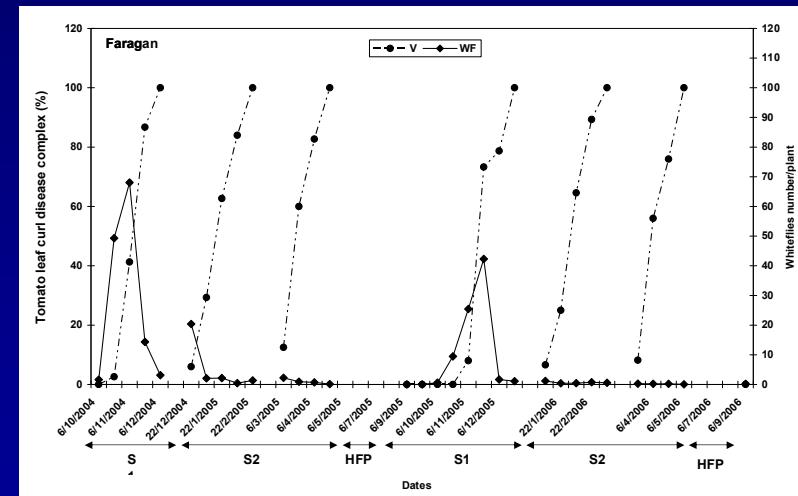
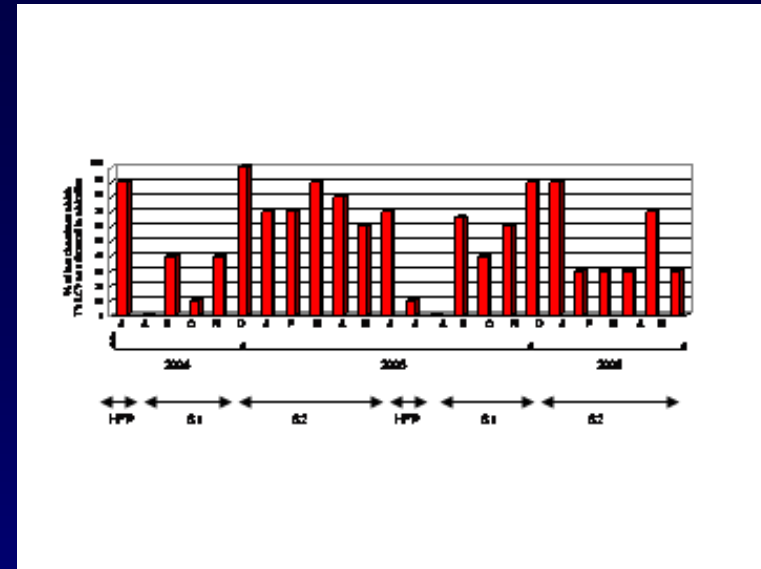
ÉMeetings were conducted with chiefs of the
local villages to explain why the host free
period was needed

ÉThe host-free period was implemented
along with the planting of early maturing
hybrids and a regional sanitation program
beginning in 2005



Voluntary host-free management of begomoviruses in West Africa

- É Sanitation program initiated: old tomato and pepper plants removed after harvest
- É Tomato and pepper free period implemented in June-August
- É Seeds of early maturing hybrid tomatoes were distributed to selected farmers
- É Monitoring program developed to assess the success of the program
 - Development of virus symptoms
 - Detection of virus in whiteflies
 - Monitoring of whitefly populations
- É Saw a reduction in virus levels in whiteflies, delays in development of whitefly populations and virus symptoms and high yields associated with the host-free period



Voluntary host-free periods for management of begomoviruses in West Africa



- É This program has been ongoing for 5 years
- É Has allowed for the return of tomato production to Baguineda (in fact bumper crops have created a need for storage technologies)
- É The overall importance of WTGs is declining in Baguineda
- É Farmers have embraced the program and are seeking to purchase seed of the early maturing hybrids
- É An NGO has scaled-up the program to access more farmers in Baguineda and other locations
- É Host-free periods are being expanded to new areas in Mali



Period can be an effective tool for management of WTGs

- É Based upon knowledge of the biology of the virus
- É Should be part of an IPM program (e.g., combined with an effective sanitation program)
- É Sustainable and inexpensive
- É Must be a regional effort
- É Can be voluntary or enforced
- É Could be used anywhere where WTGs are a constraint on tomato production

