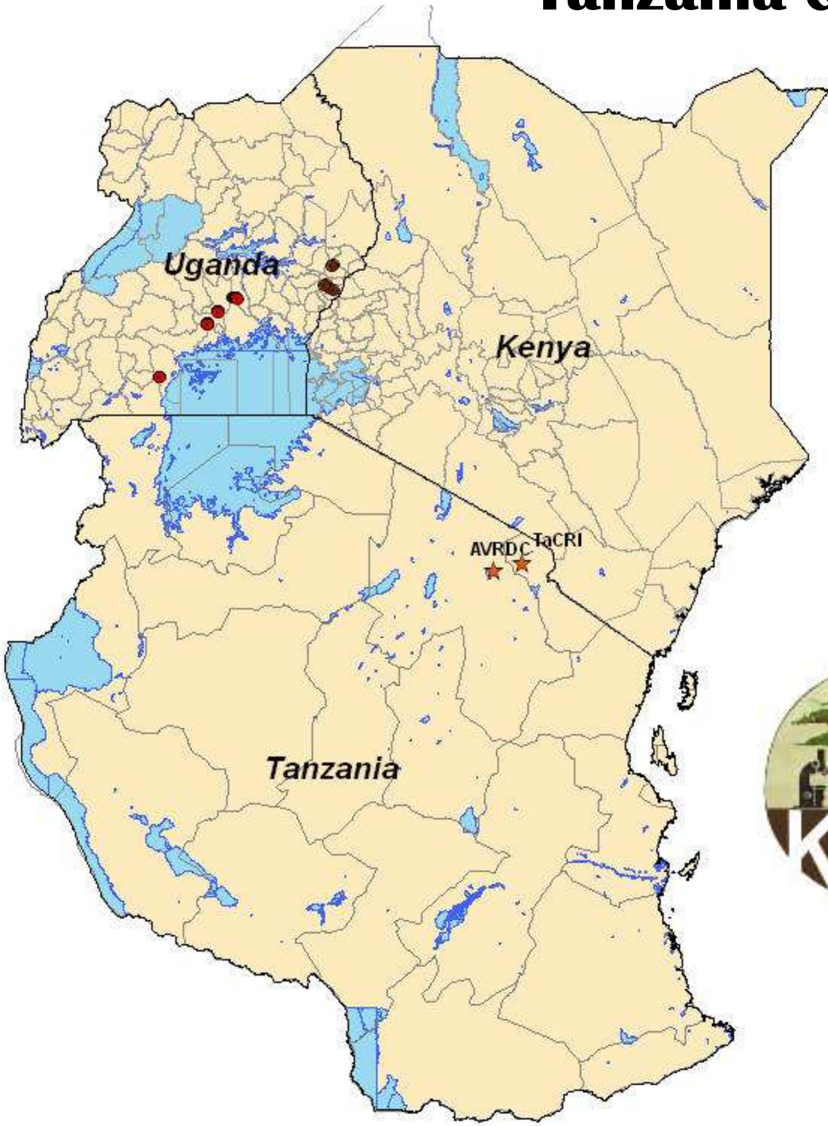
Phase 2: Regional IPM CRSP Program for East Africa: Kenya, Tanzania & Uganda



Partners

USA

- The Ohio State Univ.
- Virginia Tech.

Global Themes

- IPDN-Diagnostic Labs
- Plant Virus Diseases
- Impact Assessment
- Gender Knowledge

Regional

- Makerere Univ./FA
- Kenya Agricultural Research Institute (KARI/Thika)
- Sokoine Univ. of Agric. (SUA)

Supporting

- NARO: NaCRRI, COREC
- TACRI
- IITA

East Africa IPM CSRP Site

Making direct & unique contributions

Feed the Future objectives

- **Reducing malnutrition**: inc. production & consumption of fresh produce

- **Reducing poverty**: enhanced income by selling horticultural products or by lowering production cost

- **Gender equity:** promoting gender equity at all levels of our effort: scientific level (number of female co-PIs probably outnumbers males) and at the farm level we continue to focus on the needs of women producers

- **Environmental Sustainability:** reducing pesticide use, training farmers on safe and sound pesticide usage, and looking at ecological practices to sustainably manage pests (almost true)

- **Economically sustainable:** increase marketable output, incomes, and lower costs of production.

East Africa Objectives

1. **Objective:** Continue building a regional model of collaborative IPM research, training, and knowledge dissemination.
2. **Objective:** Implement a participatory and ecologically-based IPM research program focused on developing IPM packages for selected higher value marketed horticultural crops.
3. **Objective (new):** Transfer IPM knowledge & packages to stakeholders using innovative approaches.

Achieving a Collaborative Regional Program

- 5 regional meetings of RTC;
  - Sharing research results;
  - Research networking;
- Germplasm exchanges;
- Regional training;
- Web portal
  - http://www.aaec.vt.edu/ipmcrspuganda
- Participatory & collaborative IPM research

Developing IPM research programs for higher value horticultural crops.

- Strategic Planning in Nairobi
  - 20 stakeholders from region including reps from USAID and USDA
- ASARECA Survey of crop priorities
- Tomato, passion fruit, coffee, hot pepper, onions

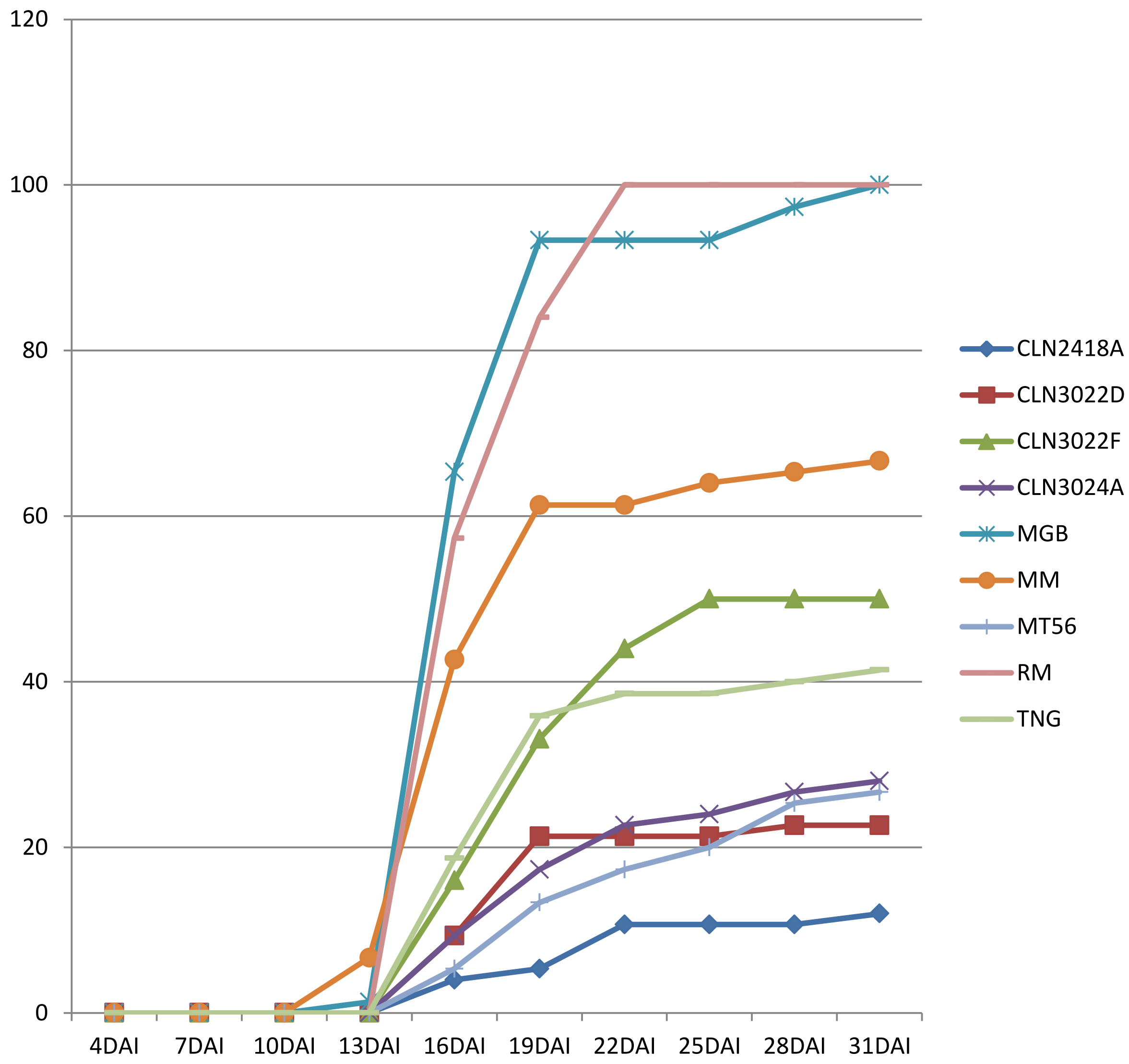
East African IPM Crops

- Uganda – tomato, passion fruit, coffee, hot pepper
- Kenya – tomato, passion fruit, onion
- Tanzania – tomato, coffee, onion

Tomato most highly ranked crop in strategic planning exercise:

Tomato Pests - Uganda, Kenya, Tanzania

Pest	IPM option
• Soil	
• Bacterial wilt	Resist. var./grafting/HT
• Fung. Bact. Nema.	Arbruscular mycorrhiza fungi
• Other dis., weed	Cultural (stake, mulch)
• Viruses	Resist var./screenhouse
• Whiteflies	Sc.house for insect exclusion
• Bollworm	Pesticide reduction



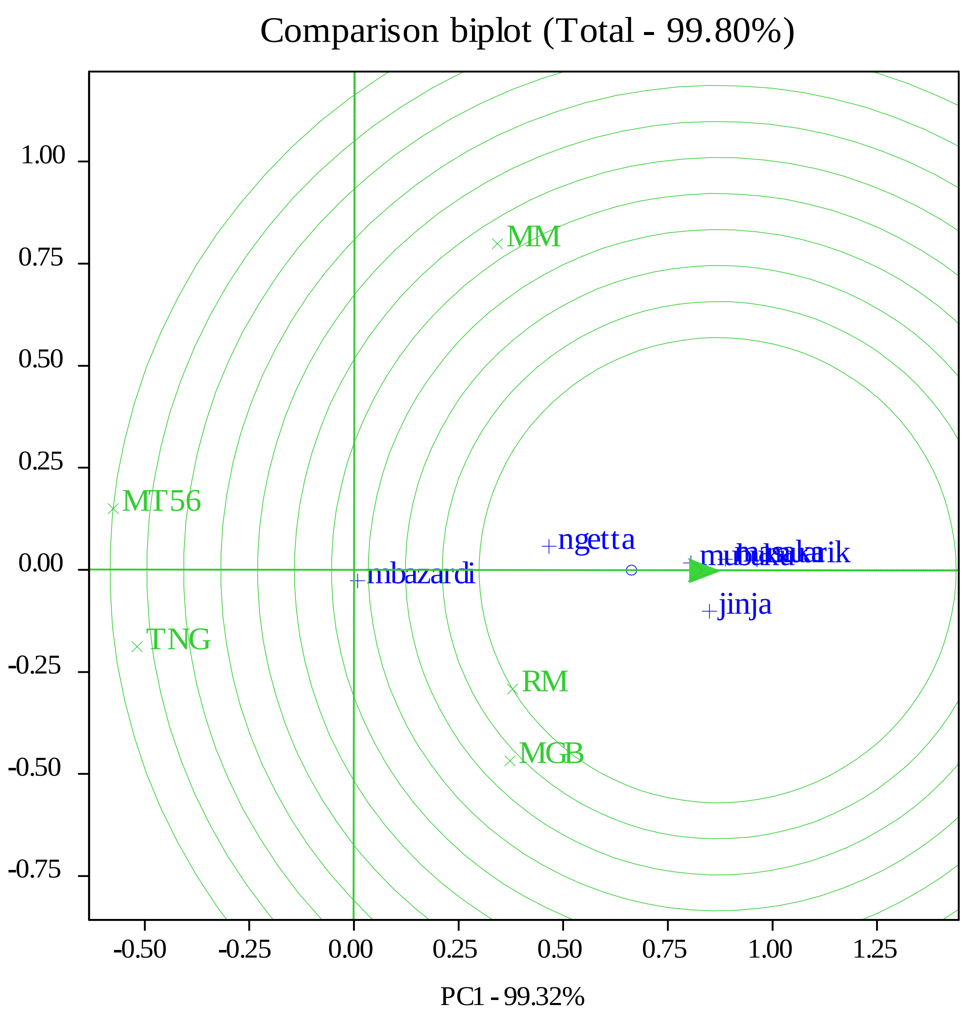
Bacterial wilt disease Indices on inoculated genotypes (Biovar 3) over a period of time

Tomato Resistant and Bacterial Wilt in Uganda (GGE biplots)

- Data Analysis
  - GGE biplot pattern explorations (Interactions)
    - Genotype (cultivar)
    - Environmental Interaction (location)

- Multiple Cultivars (green)

- Multiple Region/Sites (blue)

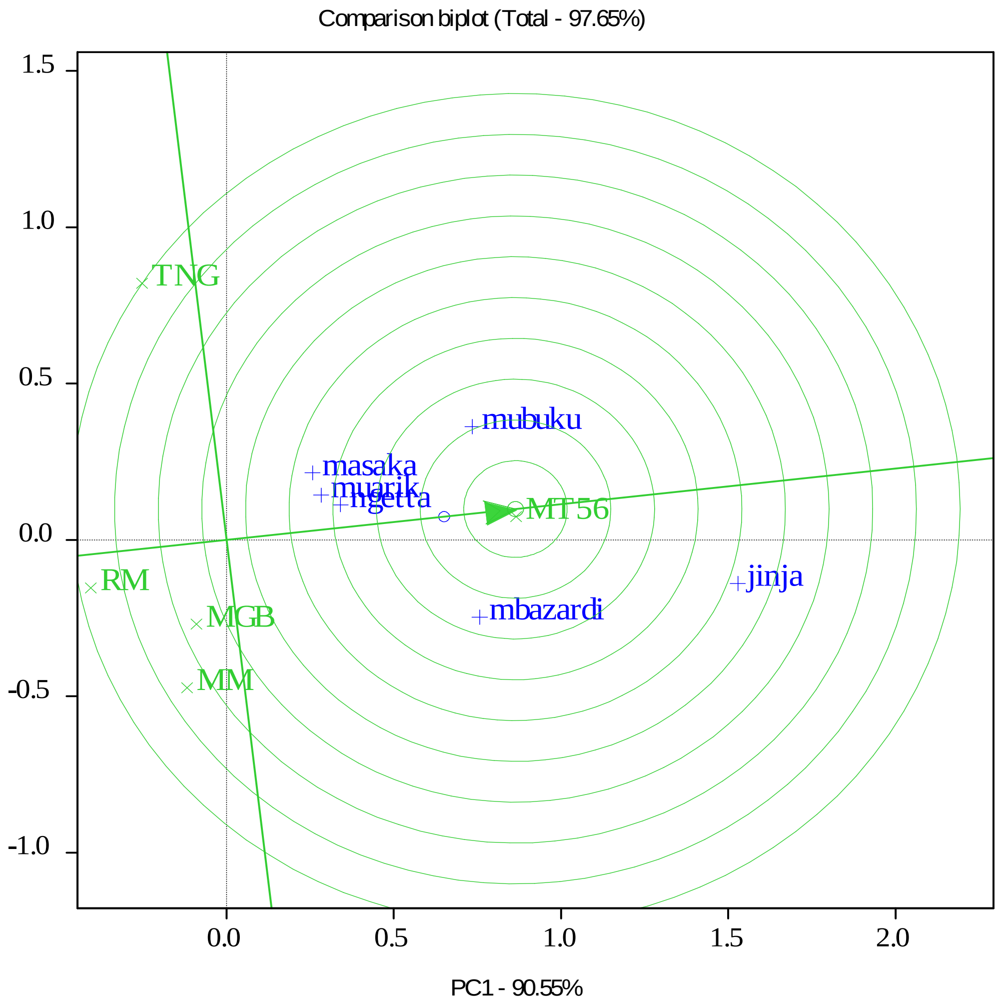


- Marglobe and Roma registered highest incidence (66.30% & 66.13% resp.) while Tengeru-97 (15.50%) and MT56 (13.13%) had the least

GGE biplot based on genotype-focused scale for bacterial wilt incidence

Yield (kg/ha) of genotypes

- MT56 was visualized as the most adapted (highest PC1 score) and stable genotype across the sites (lowest PC2 scores).
- Roma second in stability to MT56 but had the lowest yield



Genotypes vis-à-vis the "ideal" genotype based on genotype-focused scaling method for yield from the five different genotypes.

Tomato Treatments - Uganda

IPM 1 – MT56 + mulching + 3 sprays/season.

IPM 2 – MT56 + staking + 3 sprays/season.

Growers package – 1 spray/week (12 sprays/ season), own tomato variety, own management practices

Dry Season Tomatoes in Uganda

Trt	Yield (MT/ha)
IPM (mulching)	0.725 b
IPM (staking)	0.492 a
Grower Std.	0.470 a

- Farmers spraying reduced from 12 to 3Xs
- Pesticide Costs ($/Ha)
  - Farmer practice @ 12 Sprays: $586
  - IPM 1 and 2 @ 3 sprays: $146

Kenya Tomato KARI-Thika

Trt	Yield (kg/ha)	IPM cost	$ benefit
UTC	258	0 Ksh/ha	-4,670 Ks
Mulch/No In.	850	25 K	5,850
Mulch + IPM	1,379	42 K	20,643
Stake + IPM	1,993	78 K	21,449
Grower Std	2,527	116 K	15,511

Management Options - Exclusion

- Tomato grow-free period not considered acceptable;
- Begomovirus-resistant tomato hybrids being tested in the field.
- Clear polythene sheeting was placed on the nursery bed.
- Tomato seeds were then sown after one month to allow nursery solarization.
- Seedlings produced in screen houses;

Tomato – KARI-Mwea

TRT	Virus TYLC	Aphids	Miner	Whfly	Yield (ton/ha)
Schouse IPM	0.13a	0.21a	0.3a	1.0c	3.0a
Grower Std	0.14a	0.25a	0.2a	2.0bc	1.1a
Schouse No insect	0.14a	0.19a	0.3a	3.0ab	1.4a
UTC	0.22a	0.25a	0.2a	4.0 a	1.0a

Tomato – Tanzania - Weeds

Mulch – 10 or 15 cm of dry rice straw or dry grasses

<u>Results</u>

Mulch:

- Reduced fx drought for 4 wk post irrigation
- Suppressed weeds
- 15 cm rice straw was the best
- Less blossom end rot, better fruit color
- Farmers recognized, stop burning rice straw

Passion Fruit Pests (Uganda & Kenya)

Purple (fresh) & Yellow (processing, more resistance)

Pest	IPM option
• Collar rot (Fus. Wilt)	Resist. var. (Kenyan line) Trichoderma (asperellum & harzianum)
• Viruses	Resistant varieties
• Miners & mites	Resistant var.

Why diseases ?

- Yield losses-income loss
  - Up to 80% yield loss: Kenya doing 7-9t/ha in Kenya, whereas SA 20t/ha
  - 70% of the crop is of poor quality (woodiness)
  - Reduced crop life span from 5 to less than 2yrs
- Loss of foreign exchange
  - DELMONTE – Has capacity to process 100 ton/week but does less than 1/4 capacity
  - Has to import Pulp from Brazil and South Africa
- Loss of employment opportunities
  - More than 50% of original farmers have abandoned production

IPM strategies for management of major fungal passion fruit diseases

Treatments; Control of Fusarium wilt

- Biocontrol agents *(T. asperellum* and *T. harzianum,* Carbendazim)

- Cu fungicide for above ground disease control

- Paths drenched with carbendazim

- Natural inoculum

- 2 improved PF lines (KPF4;KPF12) and Purple Passion Fruit

Progress; Perfomance of *T. harzianum, T. asperellum* and carbendazim in management of Fusarium wilt and brown spot

- Fusarium wilt – Not observed in KPF4, KPF12 & PPF in 1st year of growth
- Brown spot – KPF4;KPF12 and PPF- incidences 100%, Severity of 1
- Control treatments- Incidences 100% Severity 1-2

- Scale(1= Few spots (1;1-10% spots on <50% of leaves/stems/fruits, 2;1-10% spots on >50% Leaves/stem/fruit,3-**>**30% spots on >50% of leaves

Passion Fruit: Fusarium wilt (*Fusarium oxysporium*) research: Uganda

- **Screened 26 PF rootstocks for Fusarium wilt resistance & two found to be resistant.**
- **Developed/tested cultural systems to manage Fw.**
  - **Micro-irrigation**
  - **Soil drenches**
  - **Resistant rootstock, soil drenching & mulch reduced incidence by 100%**

Virus symptoms- Fruit woodiness, ring spots and leaf curl and roll, mosaics and crinkling

Validation of virus diagnostic procedure developed at Ohio State university

- Symptomatic and asymptomatic passion fruit samples for validation of the designed primers have been collected from
  - 4 individual owned propagation facilities
  - 10 farms
  - Validation of primers designed at Ohio is ongoing

- Uasin Gishu District

- Nakuru North

Passion Fruit: Virus Research - Uganda

- Screened Ugandan germplasm collection found several yellow PF types with tolerance to viruses;
- Partial characterization of four potyvirus isolates;
- Determined that isolates were strains of same species may be novel potyvirus.

Coffee Pests

Pest	IPM option
• Leaf Disease (rust, coffee berry dis.)	modeling, pesticide management, res. var.
• Coffee root mealybug	Manure, fert, bean inter.
• Stem borer	Stem wrapping, smoothing
• Coffee twig borer	pruning, stumping, traps
• Coffee berry borer	traps, biocontrol

Screening for resistance to CBD & CLR

- TaCRI is developing compact coffee hybrids which is resistance to CBD & CLR
- 1934 cross hybrids using N39, KP 423, Rume Sudan, Hibrido de Timor and different sources of Catimors/Columbian lines were screened for CBD resistance.
- Total of 1026 of compact varieties identified to be resistant to CBD at the hypocotyls stage are under field evaluation in different ecological zones since last year

Coffee berry borer management using traps

- Established trial at Mbozi (Mbeya) and Lushoto (Tanga) using local alcohols ("Dengelua" & "Ulanzi") processed from bamboo sap & sugarcane juice in May, 2011 using painted colour traps
- Data is being collected and the analysis of data will be done after one year cycle.

Trap painted with red colour

IPM CRSP — Integrated Pest Management Collaborative Research Support Program

Rearing and multiplication of parasitoid of CBB

- Preliminary results indicated that 21 to 25 days parasitoids are emerging from berries infested with CBB
- We are trying to feed them with honey, sugar and glucose using different dilutions.

CBB parasitoid collected in the test tube

IPM technologies

- Stem wrapping and stem smoothening for stem borers control
- Organic manure, mineral fertilizer and bean intercrop for root mealy bugs control`

KIBOWA UNITED COFFEE FARMERS FIELD SCHOOL-SIRONKO DISTRICT (Buwasa Sub-county)

Onion Pests – Tanzania & Kenya

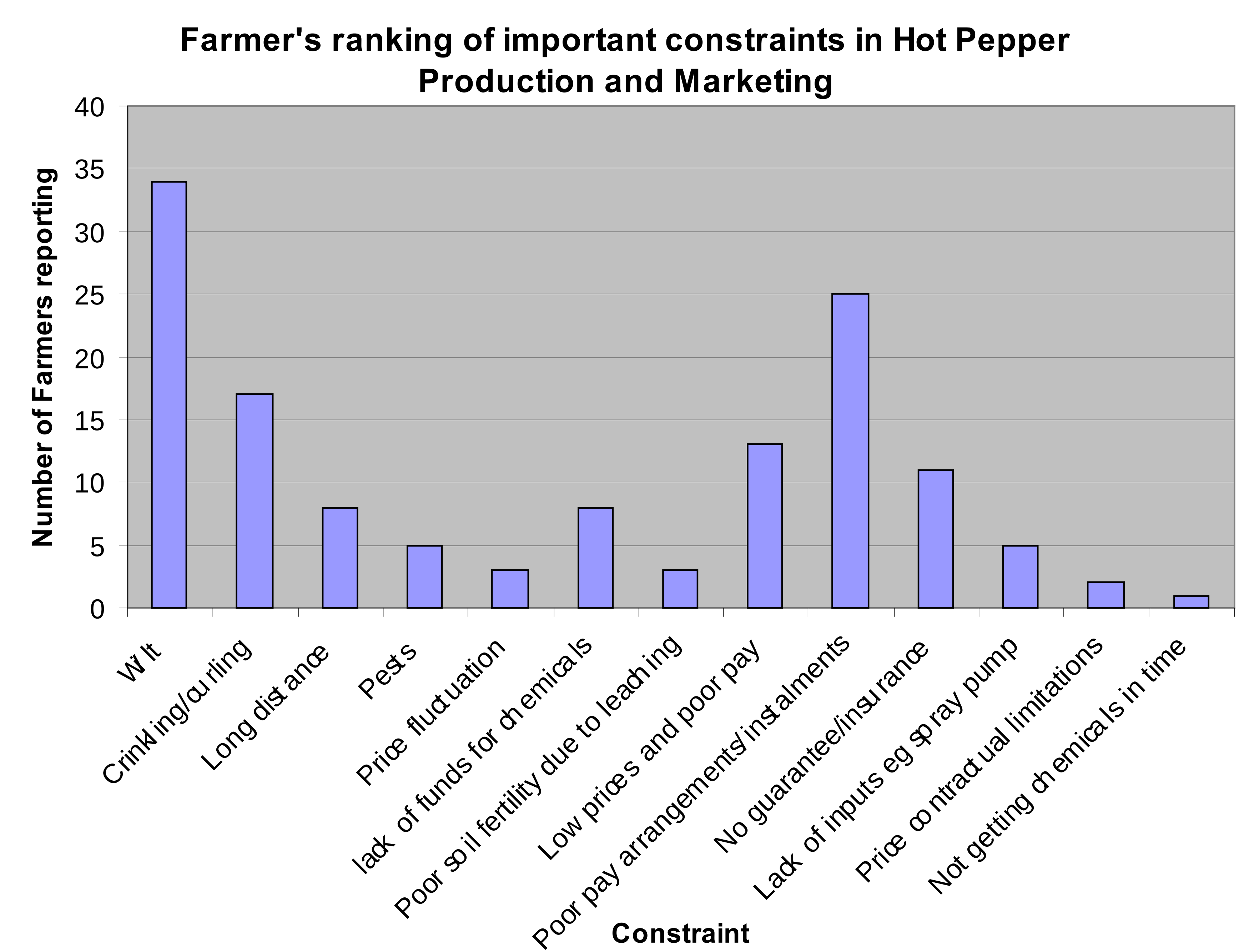
Pest	IPM option
• Grubs	ID irrigation schemes ridging resistant varieties
• thrips	
• Viruses	resistant varieties

Tanzania Baseline Observations

- Usually intercropped with corn
- IPM package needs to be introduced to onion growers at the study area
- Knowledge on chemical handling and disposal is required
- Most seeds used by farmers are farmer saved seeds. Knowledge on seed production is lacking
- Onion thrips – most important
- New pests e.g. onion grub needs a strategic control methods

Hot Pepper Pests - Uganda

Pest	IPM option
• Root rot/wilt diseases	ID
	irrigation schemes
	ridging
	resistant varieties
• Viruses	resistant varieties



Farmer's ranking of important constraints in Hot Pepper Production and Marketing
Number of Farmers reporting
0
5
10
15
20
25
30
35
40
Wilt
Crinkling/curling
Long distance
Pests
Price fluctuation
lack of funds for chemicals
Poor soil fertility due to leaching
Low prices and poor pay
Poor pay arrangements/instalments
No guarantee/insurance
Lack of inputs eg spray pump
Price contractual limitations
Not getting chemicals in time
Constraint

Effect of ridge size on wilt incidence and some yield components on irrigated scotch bonnet pepper

Ridge Height (cm)	Wilt incidence (%)	Mean Fruit number	Mean Fruit weight (gm)	Fruit yield per plant (gm)	Mean Plant height (cm)
6	42.7	69.7	20.7	1475	71.5
18	4.7	77.3	22.3	1720	70.3
30	4.7	79.0	19.3	1546	66.4
P(0.05)	<0.001	ns	ns	ns	ns

Implications of Gender and Context on the Design of IPM Programs for Tomato Growers in East Africa

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Results: Regardless of context, gender influenced access to human capital and resources: education & land in tomato production.

- Male farmers:
  - harvested & sold more;
  - More likely to apply pesticides & keep records;
  - read pesticide labels & observe 12 hour wait period;
  - To do field scouting
- Implication: Gender differences need to be acknowledged & incorporated in program design & implementation.

Contextual differences predominated:

- Morogoro more land in tomato & sold more;
- Mwea used more pesticide safety & field scouting;
- Mwea more organic fertilizer;
- Varietal preference differences;
- Marketing outlet preferences

Implications:

- One size does not fit all & programs need to be tailored to specific contexts in which gender relations unfold.
- Morogoro needs pesticide safety programs

Contextual similarities in tomato production:

- Theoretical implication:

For higher value marketed crops, the gender-specific nature of traditional African farming may be transitioning.

- The traditional male/cash crop, female/food crop dichotomy may no longer fit.

- IPM program implication:

Intensive horticultural cash crop production suggests a contextual basis for differentiating the need and demand for IPM programs.

- Need to develop alternatives to pesticides, training on pesticide usage & safety, & market driven plant breeding.

Future Directions

- More work on alternatives to pesticides
- Cross country research replication needs to continue and improve
- Continue linkages between research & extension ultimately moving information to farmers